ENGINEERING AND MINING JOURNAL

A McGRAW-HILL PUBLICATION

JUNE 1953

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FOUNDED 1866

The Remarkable Case of the Copperhill Ball Mill

When ball load decreased
power decreased
but...
Tonnage went up—
Why?... See p. 86

ALSO:

Mexico's Growing Sulphur Industry....p. 77

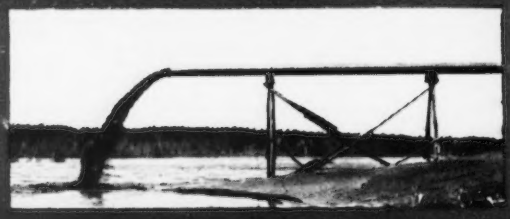
A New Forecast of Iron Ore Supply....p. 80

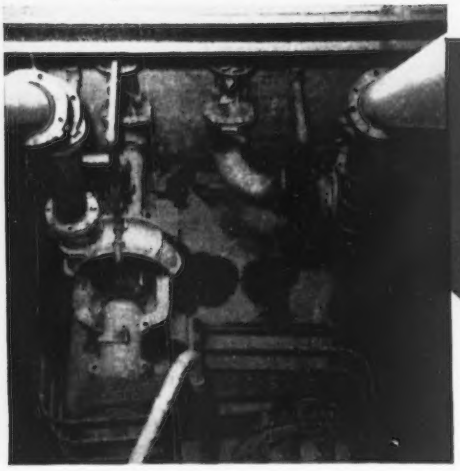
Better pumping saves money

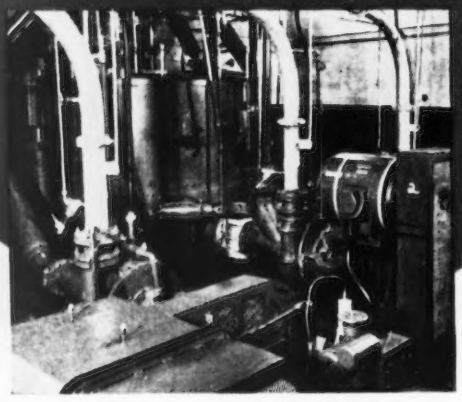
on these big, tough jobs

Mesabi iron-ore concentration plant

Iron-ore tailings discharging at pressure of 231 feet. Pumped by G-Frame Hydroseal through 7700 feet of 18-inch pipe at the rate of 446,400 gallons of pulp per hour. Static lift overcome is 76 feet.





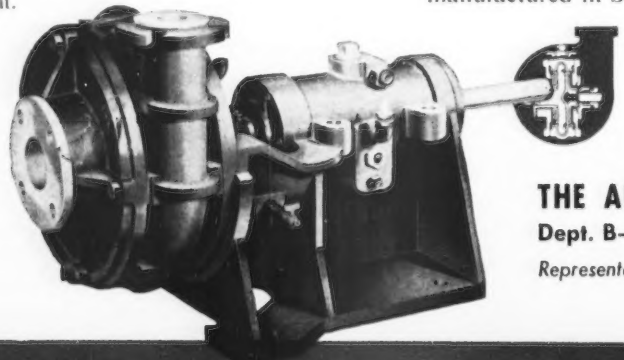


Southern coal-washing plant

Three of the twelve Hydroseals (including stand-bys) that do the heavy work at this big installation in Concord, Alabama. Day in, day out, these pumps handle 1000 tons of coal per hour with a minimum of power and maintenance.

Copper plant in the Southwest

Two of the eight Hydroseal Sand Pumps (Frame B-C) which handle the ball-mill discharge at this major copper producer. Each pump can handle approximately 5500 tons of solids per day, the pulp containing 65% solids by weight.



If it's a problem of handling fluid-solid mixtures, you can't go wrong if you consult your nearest Hydroseal engineer. Backed by hundreds of successful installations in all parts of the mining world, he is well fitted to help you design the best system for your plant. And because Hydroseals are manufactured in Sweden, South Africa and Australia, as well as the United States, you are assured of prompt and efficient service wherever you are. Write for our latest catalog.

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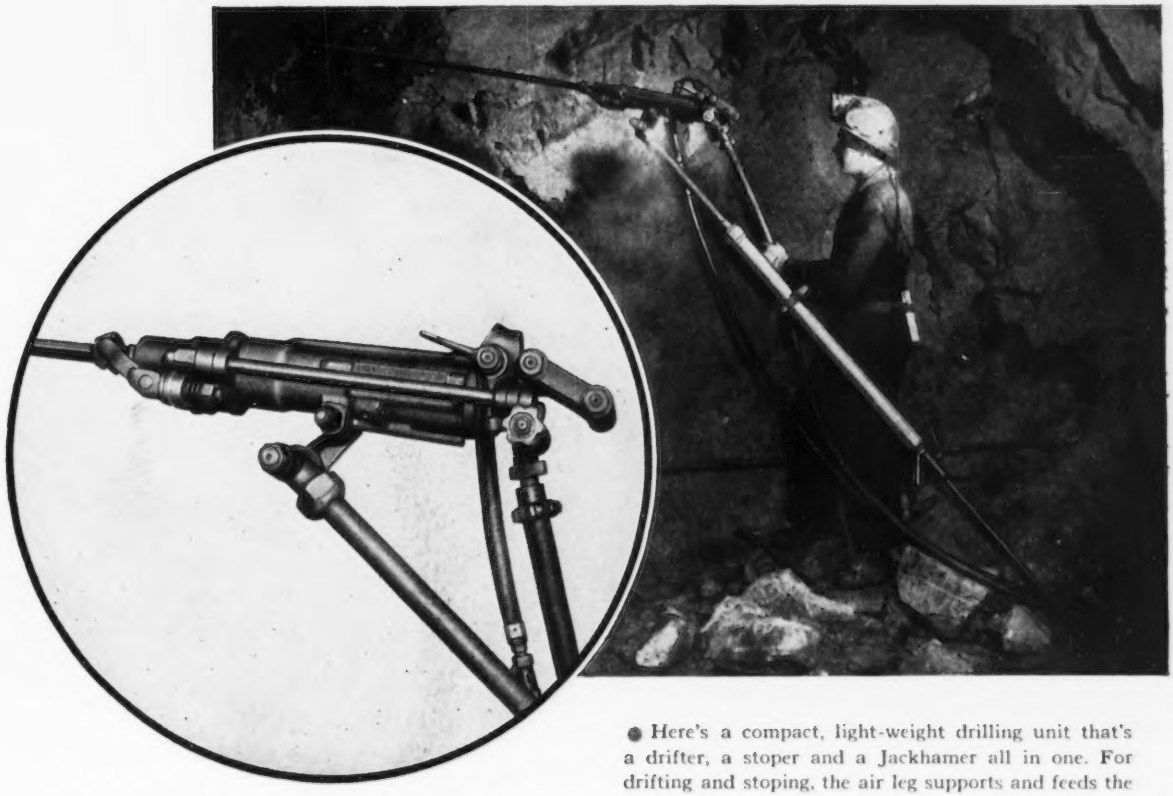

IT'S THE FIRST COMPLETELY INTEGRATED JACKLEG DRILL EVER DEVELOPED!

Check these time-saving and labor-saving features:

- One throttle controls all five operating positions—blowing; shut off; feeding; collaring and drilling.
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- Feed leg air can be shut off at the throttle without disturbing pressure adjustment.
- Built-in air connection through the feed-leg mounting-support eliminates the third hose.
- Adjustable balance and adjustable hinge tension reduce operator fatigue.
- Constant chuck blowing protects the drill and keeps the hole clean.
- Hole cleaning water is automatically turned on when the throttle is opened.

● Here's a compact, light-weight drilling unit that's a drifter, a stoper and a Jackhamer all in one. For drifting and stoping, the air leg supports and feeds the drill automatically. Detach the feed leg, by loosening a single nut, and you have a powerful Jackhamer for down-hole work.

The drill and feed leg are designed as a single, integrated unit, with all controls conveniently grouped on the drill backhead. Air for the feed leg is admitted through the drill mounting support, eliminating the need for a separate air hose. These and other advanced Jackdrill features mean faster, easier setups and simplified control of all drilling operations.

The JR-38 Jackdrill is available with 2', 3' and 4' feed legs and a full range of drill rotations. Total weight with 3' feed is only 88 lb.

THIS DRILL MUST BE SEEN IN ACTION TO BE FULLY APPRECIATED. ASK YOUR I-R REPRESENTATIVE FOR A DEMONSTRATION.

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THAT'S just one of several Euclid Loaders speeding construction on the New York Thruway. Every day hundreds of tons of heavy gravel and clay are dumped on the belt. In tough service like this, the average conveyor belt can't stand the combination of impact, belt speed and abrasion. But construction engineers have found that the B. F. Goodrich belt, with a built-in shock absorber, can outlast by more than 3 times the life that can be expected of ordinary belts.

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JUNE, 1953

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NUMBER 6

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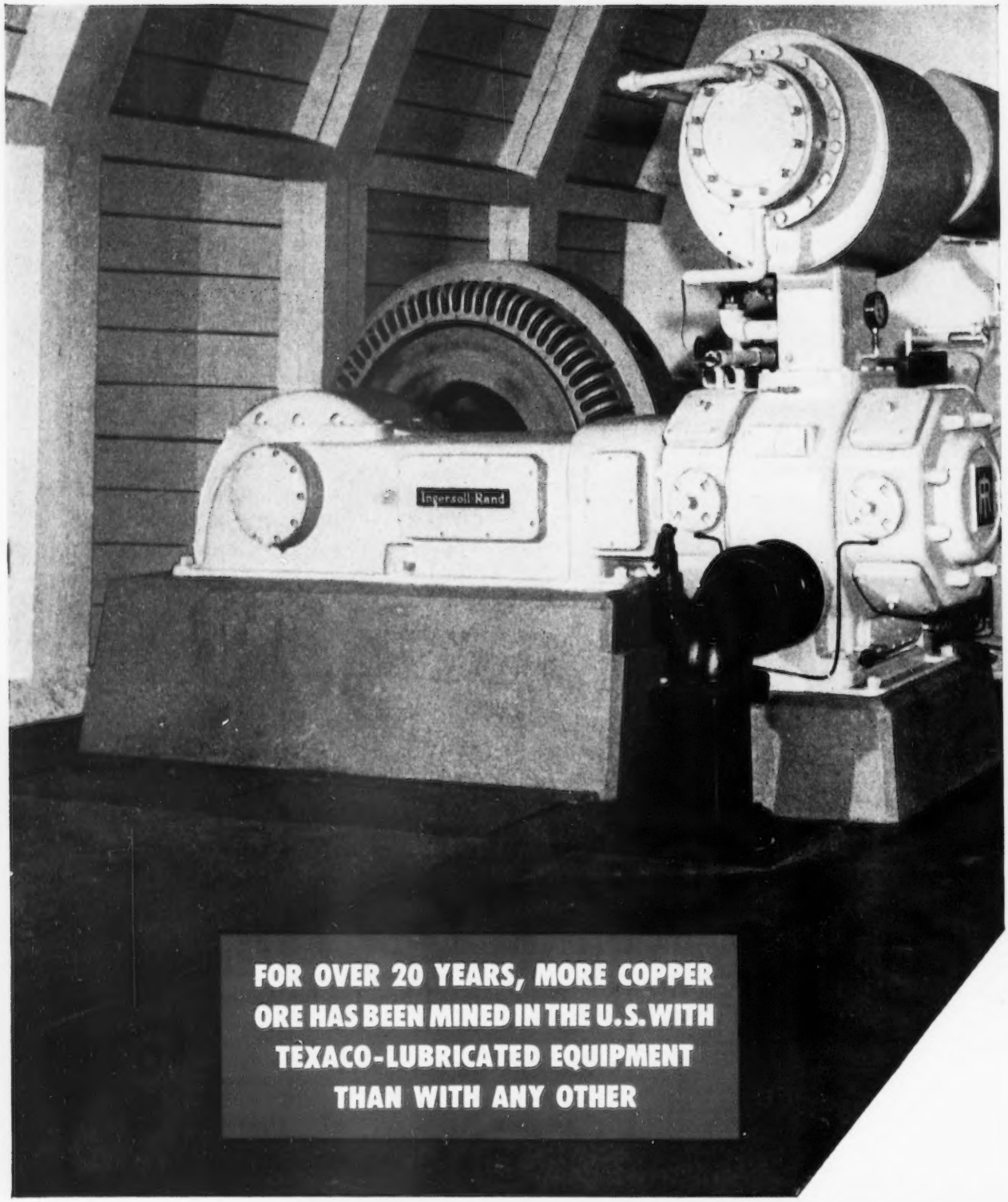

FOR OVER 20 YEARS, MORE COPPER ORE HAS BEEN MINED IN THE U.S. WITH TEXACO-LUBRICATED EQUIPMENT THAN WITH ANY OTHER

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2 facts to remember about

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For longer drill life, use *Texaco Rock Drill Lubricant EP.* It guards against wear, and protects against rust whether drills are running or idle.

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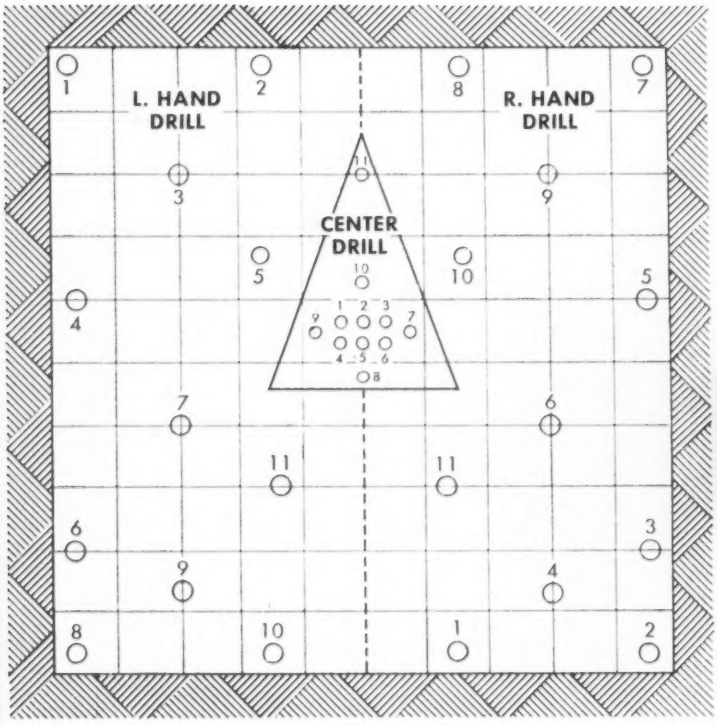
FOR THE MINING INDUSTRY

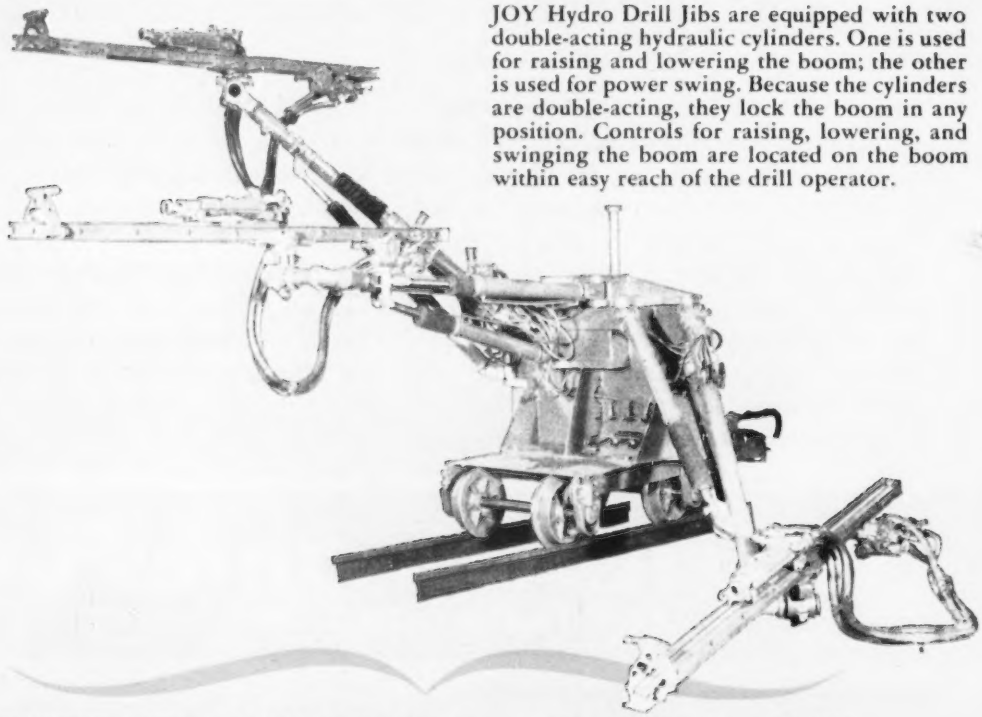
"DRILL OUT THIS ROUND"

said the Joy Engineer . . .



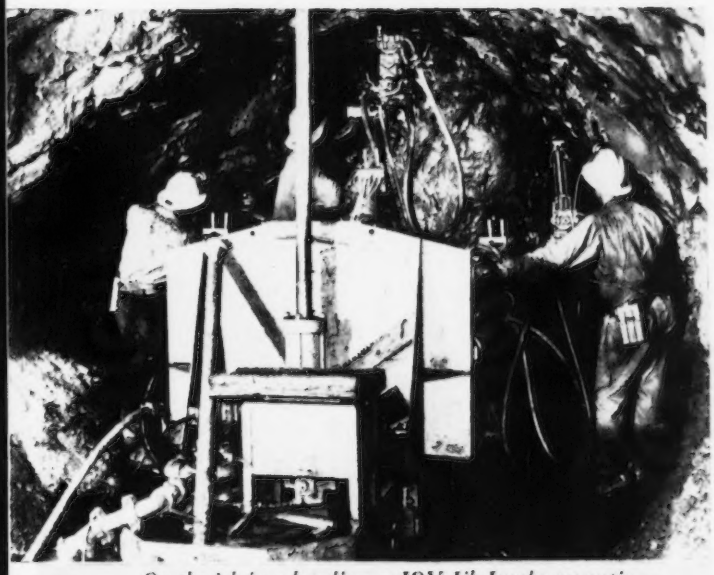
JOY Hydro Drill Jibs are equipped with two double-acting hydraulic cylinders. One is used for raising and lowering the boom; the other is used for power swing. Because the cylinders are double-acting, they lock the boom in any position. Controls for raising, lowering, and swinging the boom are located on the boom within easy reach of the drill operator.

MAXIMUM VERTICAL RANGE WITH VARIOUS LENGTH BOOMS: 10 to 14 FEET



MAXIMUM LATERAL RANGE WITH VARIOUS LENGTH BOOMS: 18 to 28 FEET

"IN RECORD TIME and WITH LESS EFFORT with JOY HYDRO DRILL JIBS"



On the job in a heading: a JOY Jib Jumbo mounting three Hydro Drill Jibs with JOY T-300 drifters.

JOY builds a complete line of Jib Jumbos and Drillmobiles. Above: a twin-boom JOY Drillmobile, rubber-tired and self-propelled for quick, easy mobility.

The recommendation above was made by one of Joy's drill mechanization specialists. He made it to a mining company which is now a satisfied user of the equipment recommended: four Joy Jib Jumbos (see facing page) each mounting three Joy T-300 Drifters on LW-6A long chain feeds. He went on to say—

"The LW 6A feed, easily supported by the Hydro Drill Jib, has an overall travel of 8 feet with a steel change of 6 feet. Thus, the proposed round can be drilled with one length of steel."

He then proposed and fully explained a drilling pattern (again see facing page) for a 10′ x 10′ round, showing the location of the eleven holes to be drilled by each one of the three jib-mounted drills. Basically, the plan provided for the least interference, and the maximum amount of drilling without dumping or swinging the drills. The holes for each drill were numbered so that the spreads between gave the runners plenty of working room. He closed by saying—

"The purpose of this proposal is to describe the many advantages of Joy fully automatic Hydro Drill Jibs. Joy pioneered the hydraulic drill jib and is still maintaining the lead in the design of this type of rig. We are keeping ahead with sound, practical improvements, and today believe we produce the finest drilling equipment available."

● Why not let a Joy drill mechanization specialist look over your problem and solve it the way he did this one? *Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa. In Canada: Joy Manufacturing Company (Canada) Limited, Galt, Ontario.*

Consult a Joy Engineer

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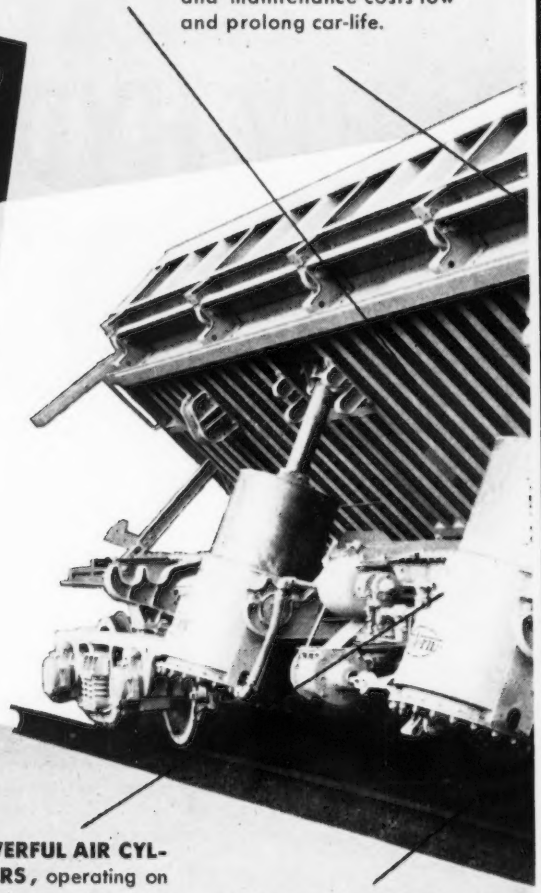

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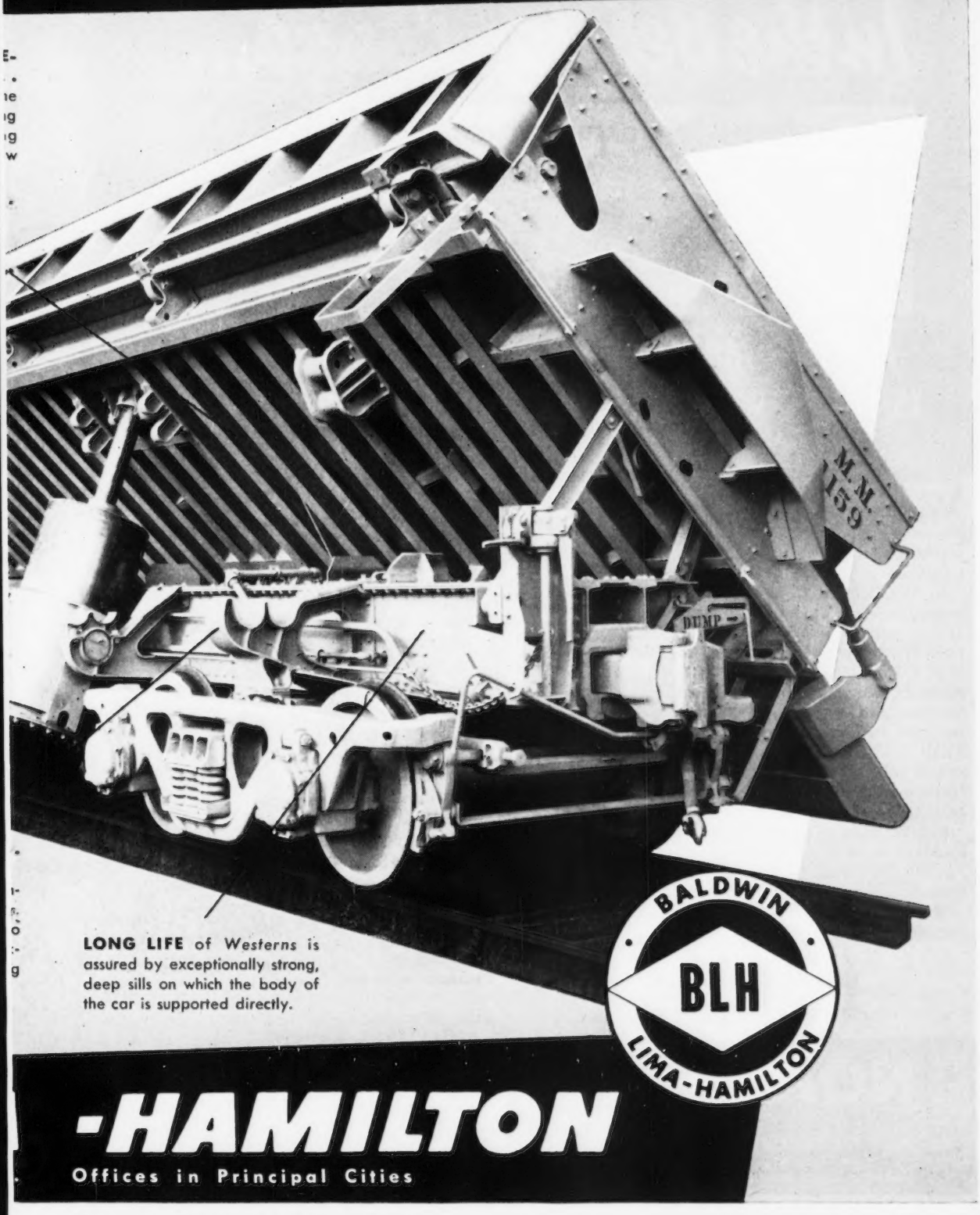

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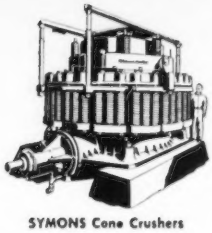
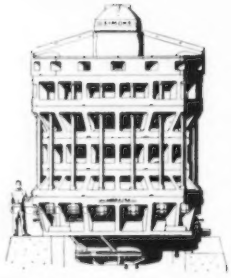
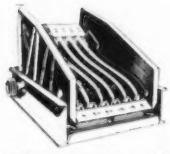


SYMONS Cone Crushers



SYMONS Primary Gyratory Crushers



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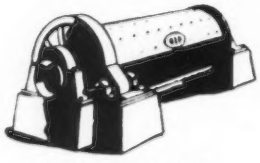
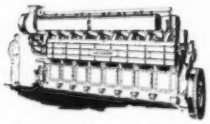


NORDBERG Grinding Mills



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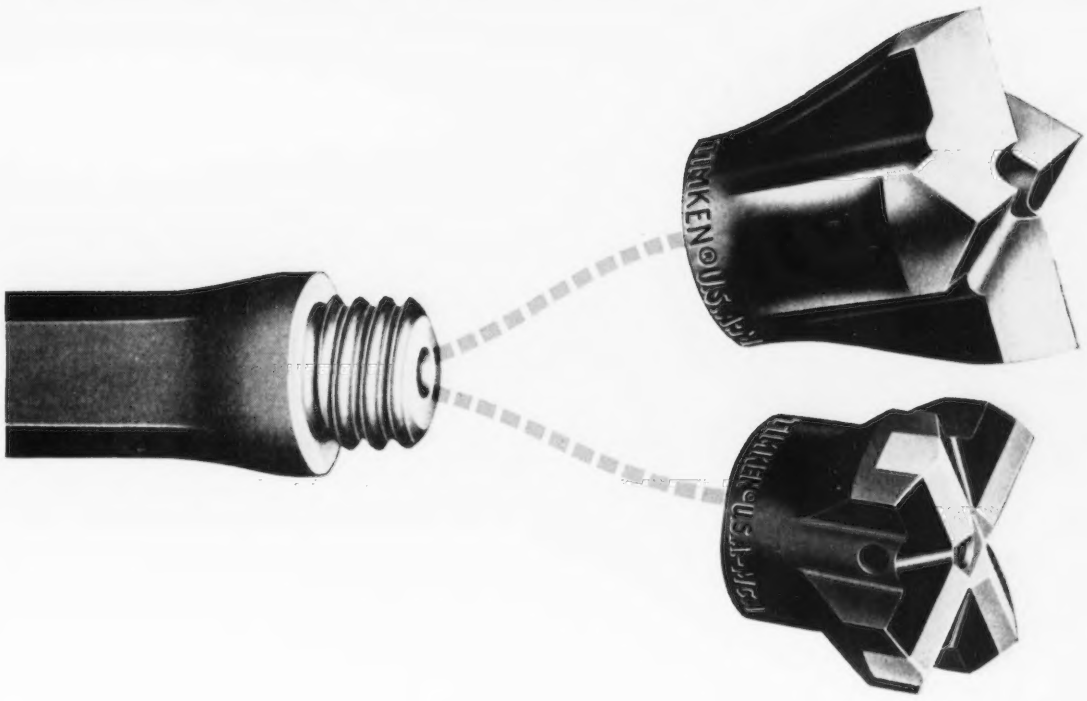

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. . . for <u>every</u> job

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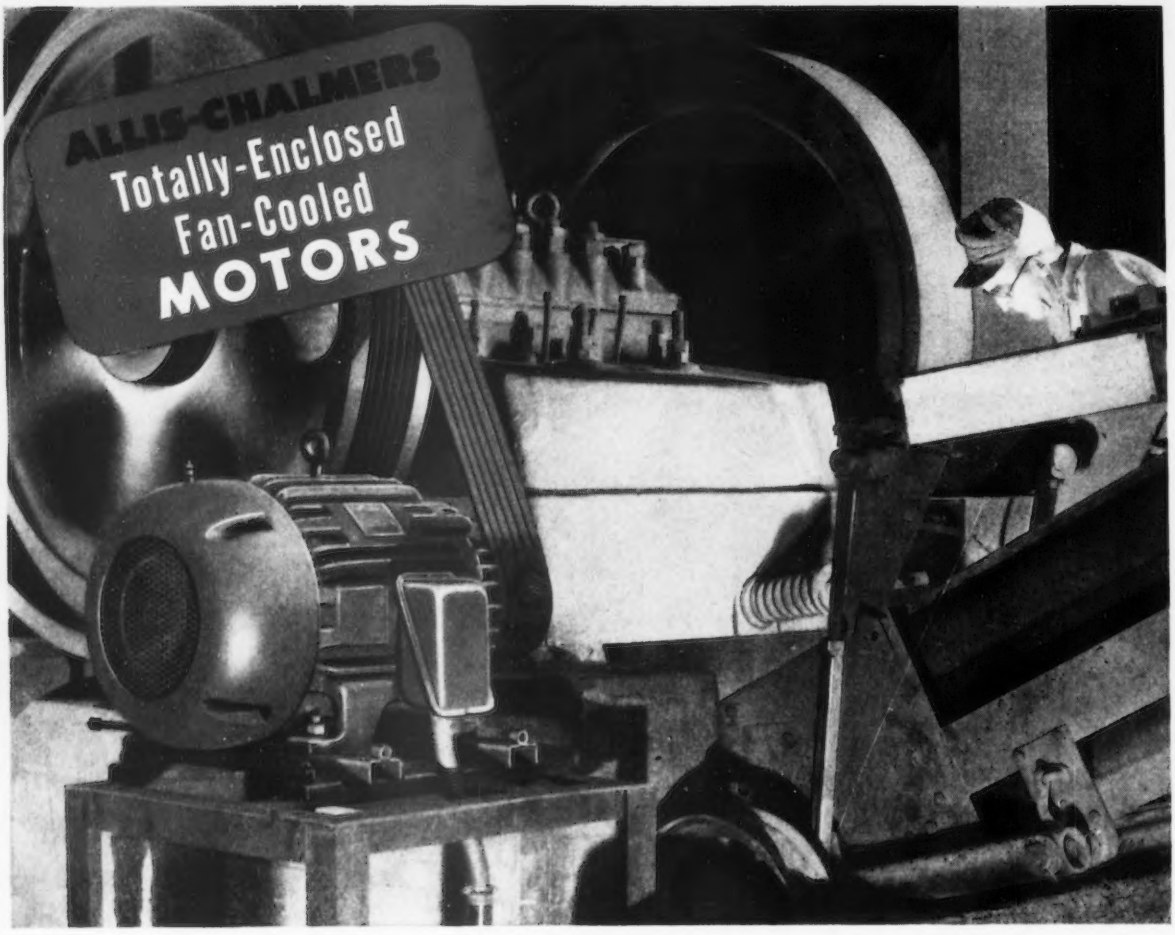

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PUSHING IRON ORE out at LOVELOCK, NEVADA!

5

No. 5 NORTHWEST for MINERAL MATERIALS COMPANY

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NORTHWEST ENGINEERING COMPANY
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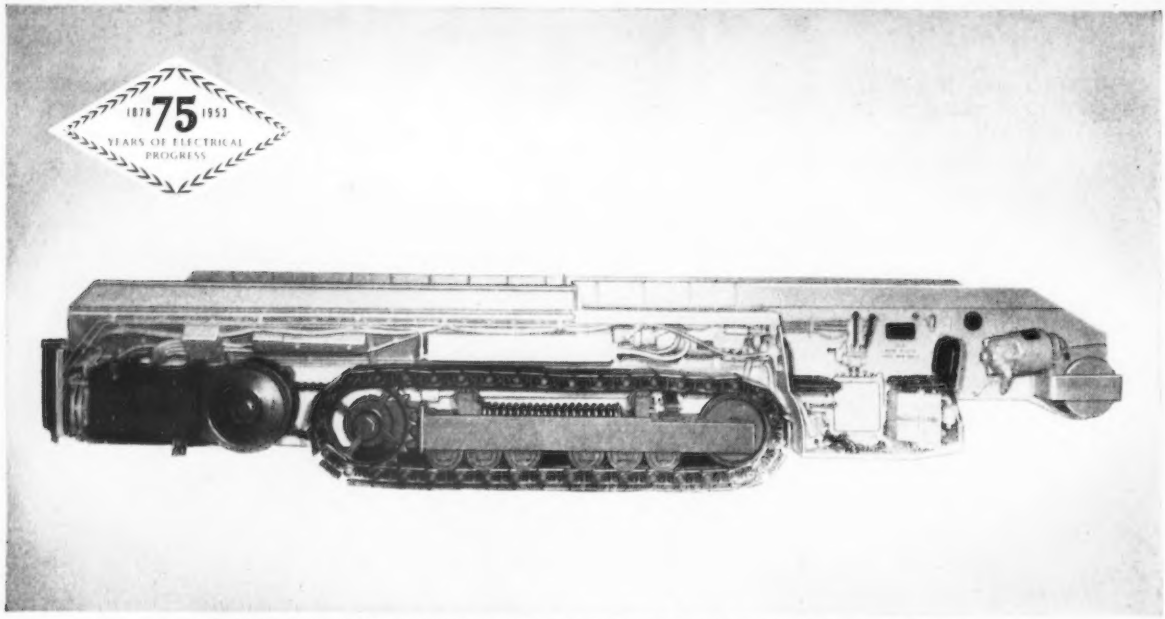
NORTHWEST

Convertible for any Mining Material Handling or Excavation Problem



G-E CABLE-REEL SHUTTLE CAR IS HIGHLY MANEUVERABLE, HAS 14-FOOT TURNING RADIUS

Quantity Production of G-E Shuttle Car Under Way

Extensive Field Tests Prove Its Versatility, Easy Maintenance Under Rigorous Mining Conditions

Eighteen months ago the G-E cable-reel shuttle car went into service under actual mining conditions to prove its worth. After heavy-duty service under all types of conditions—wet bottoms, narrow passageways, sharp turns—the verdict of operators was enthusiastic. Now, with quantity production under way, you can take advantage of this timely tool for more efficient, economical mining.

Crawler Treads Allow Large Capacity

Crawler treads on the G-E shuttle car make possible a wide conveyor, great carrying capacity, and excellent maneuverability either in passageways or at the loading machine. Ground pressure with the empty car is only 10 pounds per square inch. When fully loaded, using sideboards, the car still has only 20 pounds per square inch ground pressure.

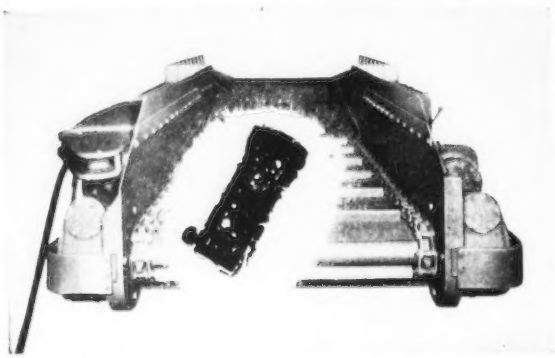
Only 42″ high, the shuttle car has a carrying capacity ranging from 190 cubic feet to 300 cubic feet (with 12″ sideboards). This is approximately 30% greater capacity than is now obtainable with cars of conventional design.

Dual Seating Arrangement on Shuttle Car

All motors and control devices meet U.S. Bureau of Mine's specifications. A dual seating arrangement with two conveniently-located control handles permits operation in either direction with maximum visibility and comfort.

Construction of the G-E shuttle car is rugged and *simple* throughout. The two driving motors are readily accessible and easy to maintain. Working parts are easy to get to, easy to service.

Investigate today the many advantages and economies that can be obtained with the new G-E track-laying cable-reel shuttle car. For full information, contact your nearest G-E sales office. *General Electric Co., Schenectady 5, N. Y.* 120-61



End view of G-E shuttle car shows wide conveyor and large carrying capacity made possible by crawler treads.

You can put your confidence in—

GENERAL ELECTRIC

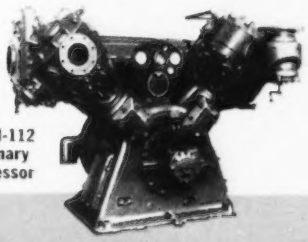
Consult a Joy Engineer

FOR THE WORLD'S MOST MODERN TYPES OF UNDERGROUND MINING EQUIPMENT

DESIGNED TO HELP YOU INCREASE PRODUCTION AND REDUCE COSTS

JOY Equipment for the metal mines includes a complete line of slushers, hoists, continuous-type trackless loaders, shuttle cars, shovel loaders, drillmobiles and jumbos, core drills, cadmium-plated rock drills, stationary and portable air compressors, mine fans and blowers. Each unit is a leader in its field—highly compact, modern and efficient—with proved ability to increase tonnage, improve your costs, and require the least possible maintenance and attention in heavy-duty service. ● Put your problems up to JOY—the world's largest manufacturer of underground mining equipment for coal, metal and non-metallics. **Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.** In Canada: *Joy Manufacturing Company (Canada) Limited, Galt, Ontario.*

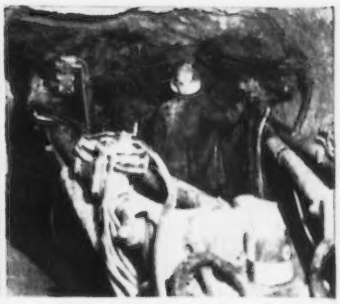
WRITE FOR BULLETINS



JOY WN-112 Stationary Compressor

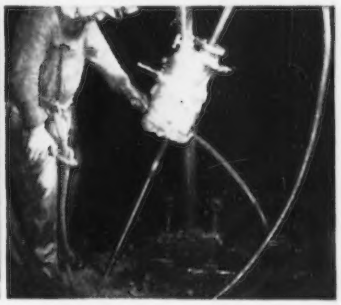
JOY Air Compressors include a complete range of portable types up to 630 CFM, and Stationary models up to 7312 CFM.

BF-212 Double Drum Slushers, electrically-driven. Models of hoists and slushers to suit every need or condition.



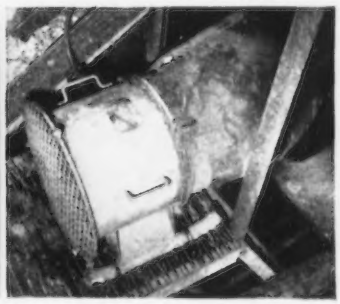
Hydro Drill Jib, separate or in single or multiple units on track-mounted jumbos. Standard or long-feed drill cradles.

JOY self-propelled Drillmobile, mounting twin Hydro Drill Jibs, meets all needs and gives you lowest-cost footage.



The Joy HS-15—a high speed drill designed specifically for underground blast hole drilling.

For modern, trackless mechanized mining, the efficient team of JOY Shuttle Cars and continuous-type Loaders.



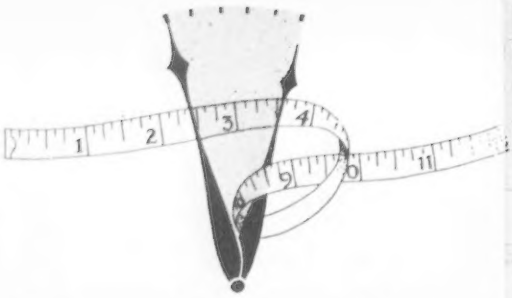
Model I-16 Portable AXIVANE Blower. Joy portable blowers are available in five sizes—from .4 H.P. to 5 H.P.

Consult a Joy Engineer

W&D MA510

JOY

WORLD'S LARGEST MANUFACTURER OF UNDERGROUND MINING EQUIPMENT



How Many Feet Will Five Minutes Buy?

Suppose your mine was shut down for five minutes because of cable failure. How many feet of cable could you buy with the money you lost? Probably a good many feet. That's why we think you should buy nothing but the most reliable for borehole and feeder cables. If your borehole cables carry high voltages underground, then they should be ANHYDREX XX.

These cables are so resistant to water that we guarantee they will not absorb more than 15 milligrams of water per square inch of exposed surface when soaked for seven days at 158° F. That's how sure we are that the cables will prove utterly resistant to water. This same insulation can be operated at copper temperatures up to 176°F. (80°C.) in either wet or dry locations.

The conductors are protected by a specially compounded neoprene jacket that is unexcelled for balanced resistance against abrasion, oil, flame, and ground acids and alkalies.

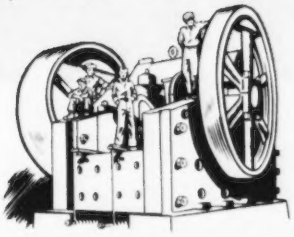
Simplex-ANHYDREX XX High Voltage Borehole and Shaft Cables do not need metallic sheaths. They are easy to handle, to splice, and to terminate. They come in single or multi-conductor types designed for the voltage range from 2,001 to 17,000 volts.

We will gladly send you more information, without obligation, of course, if you will write to us at the address below.

Simplex WIRES & CABLES

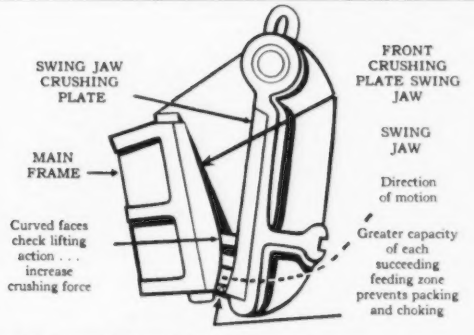
SIMPLEX WIRE & CABLE CO., 79 Sidney St., Cambridge 39, Mass.

Built BIG For BIG Production

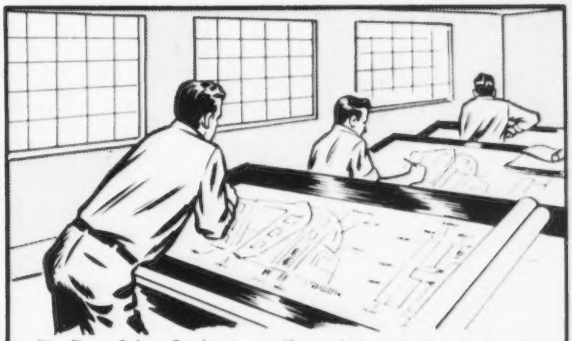


1,000 TONS PER HOUR

The Traylor Type S Jaw Crusher is the most massive jaw type breaker that's ever been built. Specially designed to stand up under the severest production schedules, it crushes up to 1000 tons per hour.


SWING JAW CRUSHING PLATE
MAIN FRAME
Curved faces check lifting action . . . increase crushing force
FRONT CRUSHING PLATE SWING JAW
SWING JAW
Direction of motion
Greater capacity of each succeeding feeding zone prevents packing and choking

Traylor's original Curved Jaw Plates apply power as a *direct* crushing force. This reduces lifting and churning . . . assures a uniform product with less wear on plates. In fact, Traylor Curved Jaw Plates outlast ordinary plates 3 to 1.



The Type S Jaw Crusher is usually made to order to meet your particular requirements and operating conditions. It is available in seven sizes with feed openings from 36" x 42" to 60" x 84". Each size has a range of from 7 to 9 different discharge openings.

EXAMINE the massive construction . . . exclusive design features . . . of the Traylor Type S Jaw Crusher. It's completely illustrated and described in Bulletin 125. For your copy, mail coupon today.

Send Bulletin 125 immediately.

Name: _____

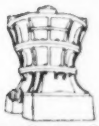
Position: _____

Company: _____

Address: _____ *State:* _____

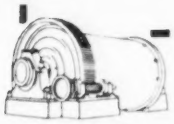
TRAYLOR ENGINEERING & MANUFACTURING CO.
582 MILL ST., ALLENTOWN, PA.

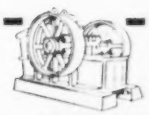
SALES OFFICES: New York • Chicago • San Francisco
Canadian Mfrs: Canadian Vickers, Ltd., Montreal, P.Q.

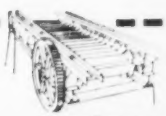

Primary Gyratory Crushers

Rotary Kilns

Secondary Gyratory Crushers

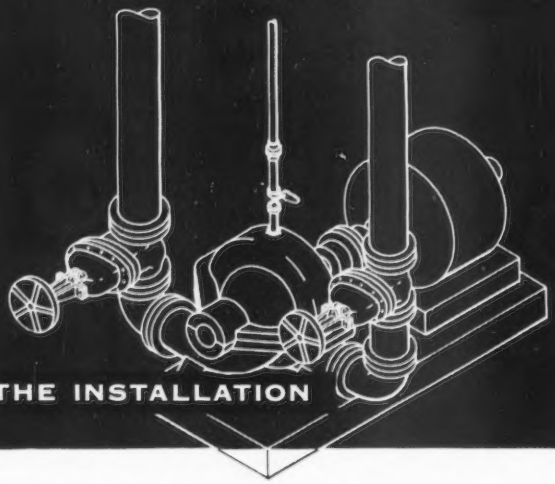

Ball Mills


Jaw Crushers


Apron Feeders

Will Your Valves Last 50 Years?

...on this Tough Pump Service, for instance



THE INSTALLATION

VALVE SERVICE RATINGS

SUITABILITY:
Doing the job for 50 years

MAINTENANCE COST:
Routine care only

SERVICE LIFE:
Installed 1903—Now on new pumps

OPERATING RESULTS:
No shutdowns for valve trouble

AVAILABILITY:
Catalog item—Current No. 465½

At The Great Western Sugar Company, Longmont, Colorado, plant, with Crane Iron Body Wedge Gate Valves on suction and discharge lines of juice pumps.

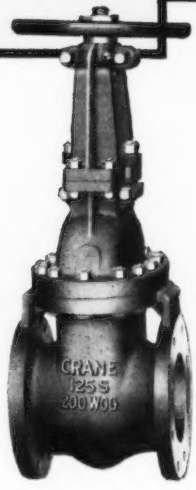
THE CASE HISTORY

Originally the Crane valves were installed on belt-driven pumps when the plant was built in 1903. In 1952, the old pumps were replaced. Nearly all the Crane valves were found in good condition and put right back in service on the new pumps.

It's no easy job these Crane 6 and 8-inch, 125-pound brass-trimmed gate valves have been doing since 1903. The plant operates on 80-day continuous beet sugar campaigns. In spite of intermittent operation, and with periodic routine maintenance only, the Crane valves never fail to operate freely, smoothly, and seat tightly. For 50 years they have assured dependable, positive flow control in event of pump failure—and they're still doing it.

THE VALVE

Here is today's model of these "50-year service record" Crane 125-pound iron wedge gates. Still made to the most rigid quality standards, these modern valves keep building unusual performance records in every industry. They come in patterns for every need. See your Crane Catalog or your Crane Representative.



THE BETTER QUALITY...BIGGER VALUE LINE...IN BRASS, STEEL, IRON

CRANE VALVES

CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Illinois
Branches and Wholesalers Serving All Industrial Areas

VALVES • FITTINGS • PIPE • PLUMBING • HEATING

"CUSHIONED" against wear

Reason Why Redwing-H Air Hose Gives Top Heavy-Duty Performance on the Job

You can depend on REDWING-H Cord Air Hose for longest, trouble-free service—even in the roughest kind of going in mines, quarries and construction operations.

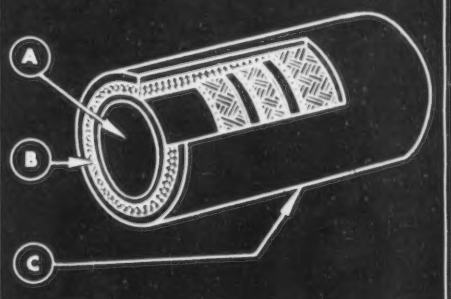
Reason is that this hose was developed by the G.T.M.—Goodyear Technical Man—to take hard knocks. Its cover—bright red in color—is resilient, tough stock that bounces away digs, cuts and abrasion. Under this super-strong cushion are multi-braids of high-strength rayon reinforcement—and a seamless, oil-resistant tube. Everything about REDWING-H adds up to longer, better service.

Ask the G.T.M. or your Goodyear Distributor about REDWING-H Cord Air Hose for your toughest jobs—available in continuous lengths, sizes from ½" to 1½" i.d. for working pressures from 200 to 350 lbs. psi. Write Goodyear, Mechanical Goods Division, Akron 16, Ohio.

GOODYEAR INDUSTRIAL RUBBER PRODUCTS

G.T.M.-Specified

REDWING-H CORD AIR HOSE



A Synthetic tube is seamless, non-porous, non-flaking, oil-resistant

B Two or three braids of high-strength rayon reinforce against shock blows

C Red cover of heavy, resilient stock bounces away abrasion, cuts, gouges

Redwing—T. M. The Goodyear Tire & Rubber Company, Akron, Ohio

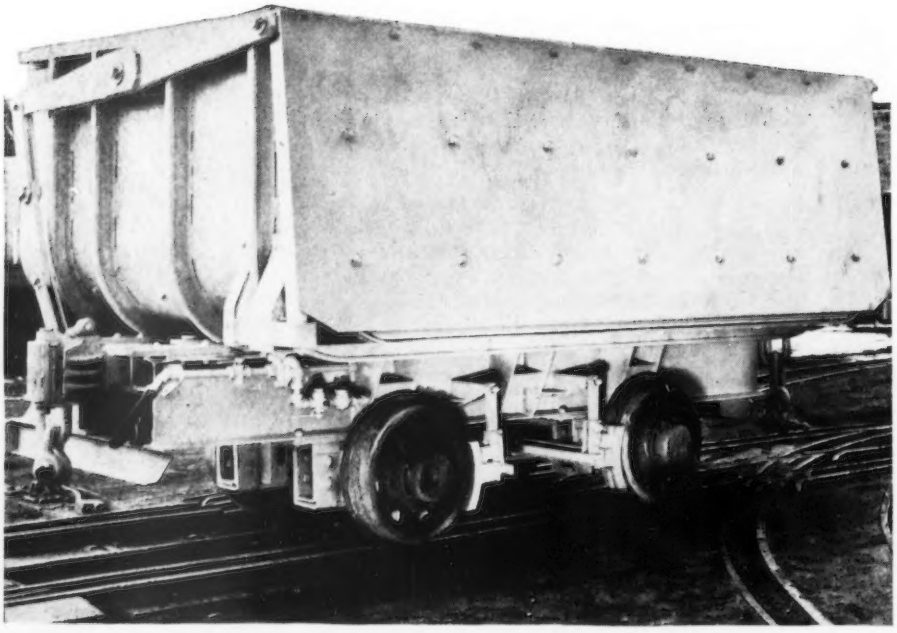
YOUR GOODYEAR DISTRIBUTOR *can quickly supply you with Hose, Flat Belts, V-Belts, Packing, Tank Lining, Rubber-Covered Rolls. Look for him in the yellow pages of your Telephone Directory under "Rubber Products" or "Rubber Goods."*

GOODYEAR

THE GREATEST NAME IN RUBBER

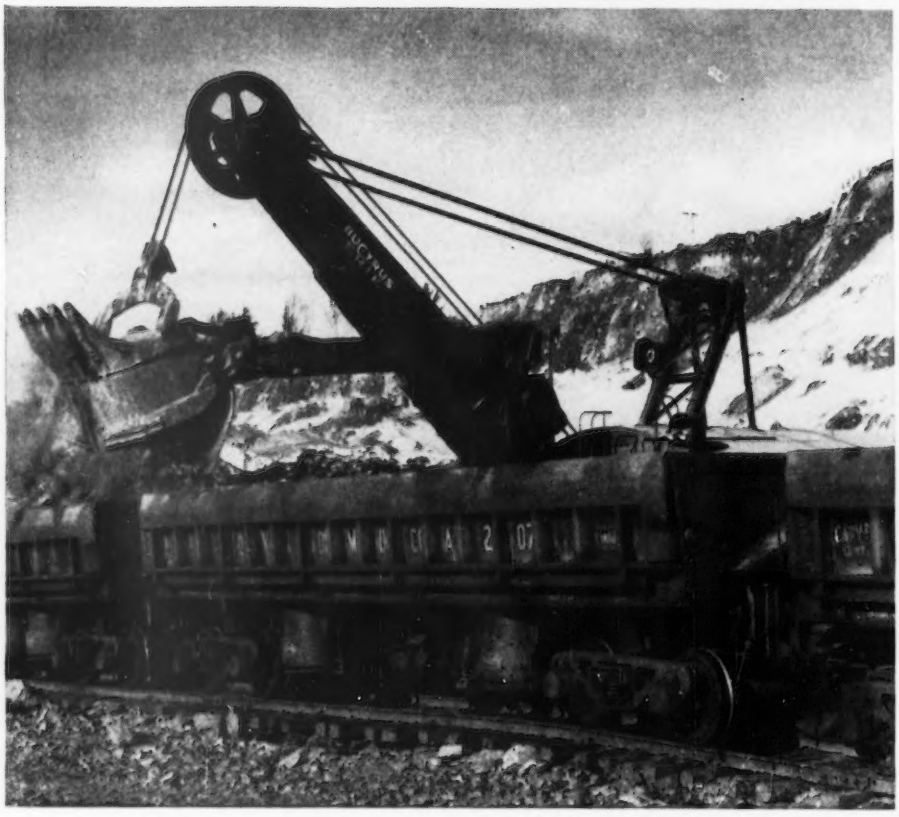
We think you'll like "THE GREATEST STORY EVER TOLD"—every Sunday—ABC Radio Network—THE GOODYEAR TELEVISION PLAYHOUSE—every other Sunday—NBC TV Network

This mine equipment does more



Still in good condition after handling 112,000 tons of abrasive ore.

30 mine cars like this were built by the C. S. Card Iron Works for the Cananea Consolidated Copper Company in 1948. U·S·S COR-TEN High Strength steel was used to make all body and liner plates. To date, each of these cars has handled 112,000 tons of ore, and every one of them is still on the job—still in good condition. These COR-TEN-built cars proved to be so durable that the Cananea Consolidated Copper Company has purchased 30 more.



Stronger, more durable. Yet, the weight of these cars was cut by 25,000 pounds.

In this application, U·S·S TRI-TEN steel was used to reduce weight without reducing strength. These 100-ton Western cars, each of which is capable of carrying 40 cubic yards of ore level-full, were built by Baldwin-Lima-Hamilton Corporation, Eddystone Division for use in a Mesabi open pit mine by the Oliver Iron Mining Division. By taking advantage of the higher strength and greater toughness of TRI-TEN steel these cars were built 25,000 pounds lighter than if plain steel had been used. Yet, the cars are stronger, more durable and better able to withstand cold weather operations. Because of reduced deadweight, each car can haul 25,000 pounds more ore than a similar carbon steel car.

and lasts longer because

U·S·S High Strength Steels

give it the stamina to stay on the job.

With higher-than-ever operating costs threatening every penny of profit, the full value of your investment in mine equipment must be realized. Every piece of equipment you use must produce to its full capacity. To do that, it must be able to take the day-in day-out punishment of today's high speed operations.

Equipment built with U·S·S HIGH STRENGTH STEELS can take that kind of punishment. And this shows up in your books. You spend less money for replacements and repairs. You get more output because there's less down-time.

U·S·S HIGH STRENGTH STEELS are used to give each part the particular qualities it needs to do its job best. U·S·S Cor-Ten steel, for example, provides four to six times the resistance to atmospheric corrosion of ordinary structural steel. U·S·S A-R (Abrasion-Resisting) steel offers maximum resistance to wear and abrasion. And U·S·S Tri-Ten steel gives equipment greater ability to withstand shock at sub-zero temperatures. It is also possible to increase the strength of a part without increasing its weight by replacing ordinary steel with either U·S·S Cor-Ten, U·S·S Tri-Ten or U·S·S Man-Ten steels. Or, conversely, weight can be reduced without reducing strength. That's because these famous "steels that do more" have a yield point 50% higher than that of ordinary structural steel.

Make sure that U·S·S HIGH STRENGTH STEELS are used in your equipment. They'll help you increase output and save you money at the same time.

For more facts, or specific application data, write to our nearest office.

Resists corrosion, even in the hot, humid atmosphere of a Florida phosphate pit.

The Caterpillar Diesel Tractor and Caterpillar Scraper shown here offer further evidence of the durability of U·S·S High Strength Steels under severe conditions. In the warm, humid atmosphere of a Florida phosphate pit, corrosion is a constant menace to equipment. U·S·S Tri-Ten steel offers good resistance to atmospheric corrosion—three times that of structural carbon steel. What's more, it offers greater resistance to shock, abrasion and impact. And its fatigue strength is 50% greater than plain steel. Caterpillar Tractor Co. has long relied on U·S·S Tri-Ten steel to give its equipment the ruggedness and durability for which it is famous.

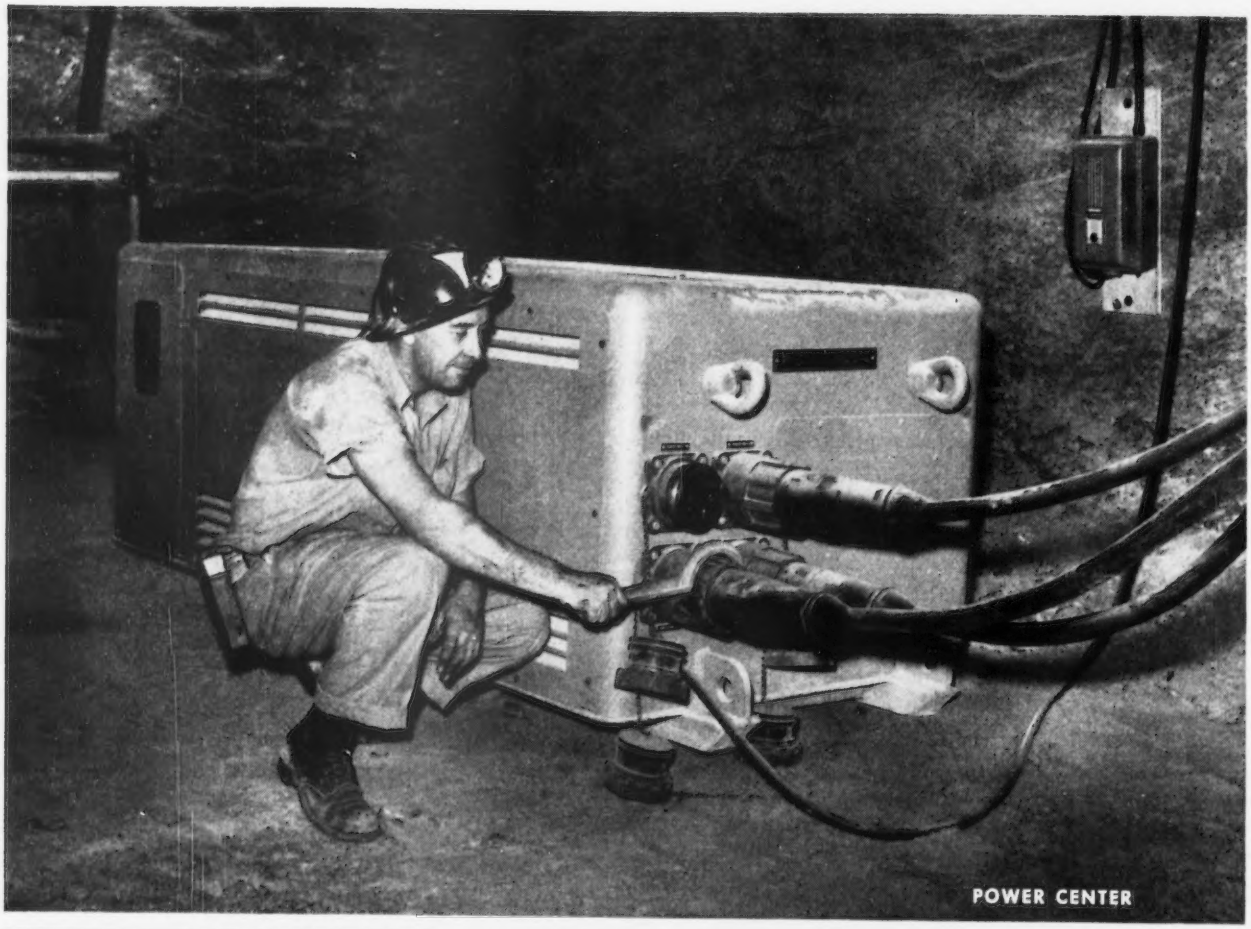
UNITED STATES STEEL CORPORATION, PITTSBURGH • AMERICAN STEEL & WIRE DIVISION, CLEVELAND • COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
NATIONAL TUBE DIVISION, PITTSBURGH • TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA. • UNITED STATES STEEL SUPPLY DIVISION, WAREHOUSE DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

U·S·S HIGH STRENGTH STEELS

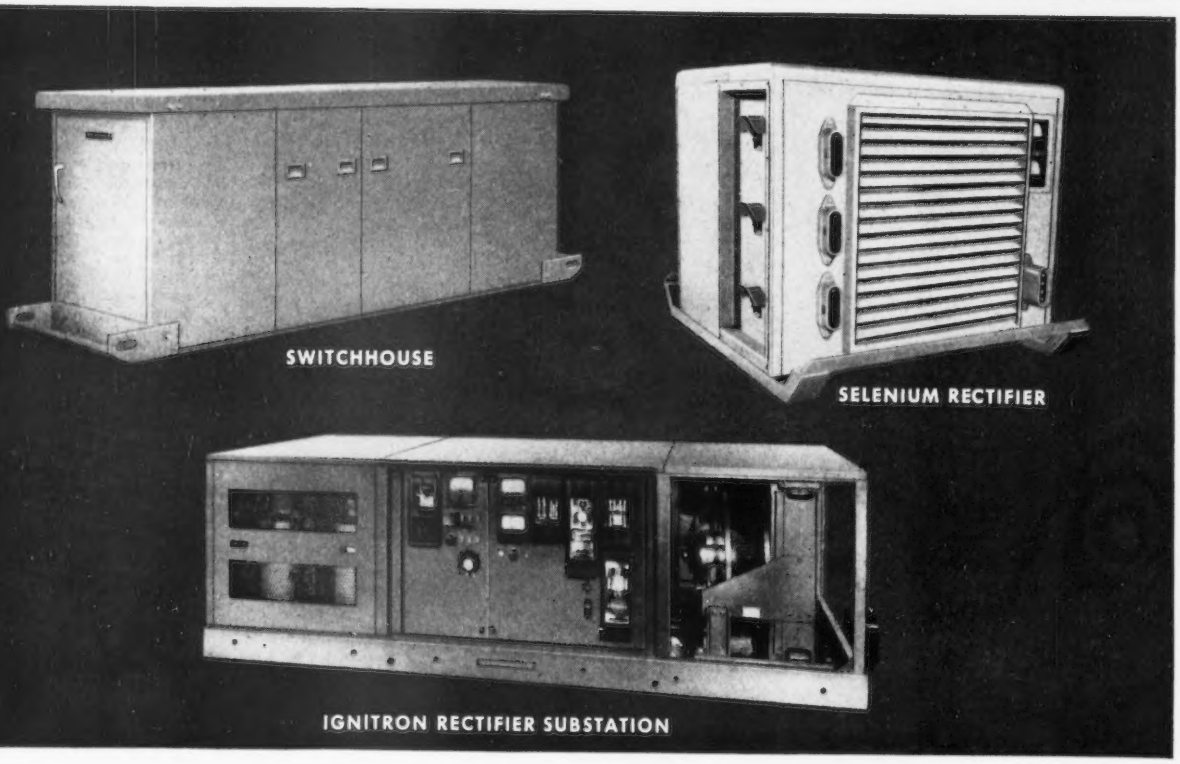
USS

3-203

UNITED STATES STEEL



POWER CENTER



SWITCHHOUSE

SELENIUM RECTIFIER

IGNITRON RECTIFIER SUBSTATION

Skid 'em in...hook 'em up!

...Westinghouse "plug-in" power packages come ready for work

No further engineering needed! No planning of related equipment necessary! Whether you use a-c, d-c or a combination of both in your mine, Westinghouse underground "power packages" are available for your needs. These complete integrated units can save you days or even weeks of installation time. They are shipped to you ready to use. Compactness and portability make it easy to move them close to the load, minimizing power losses and voltage fluctuations which result from long cable runs. Plug-type receptacles make hookup fast and easy.

Switchhouses protect high-voltage a-c circuits

Westinghouse switchhouses control high-voltage a-c circuits to high-voltage motors or power centers. Each switchhouse is equipped with a circuit breaker which automatically disconnects the circuit in case of overloads, short circuits or ground faults. Thus, trouble is isolated without impairing service to other sections of the mine.

Power Centers step down a-c power for smaller machines—Underground power centers provide low voltage close to the load. They include dry-type, air-cooled transformers which eliminate the problems connected with liquid cooling. Circuit breakers protect each outgoing low-voltage feeder. Plug-type connectors are provided for all incoming high-voltage and outgoing low-voltage circuits.

Ignitron Rectifiers supply large amounts of d-c power

For large blocks of d-c power, above 150 kw, Ignitron rectifier substations provide the most reliable and economical method of power conversion. They are delivered complete with nothing else to engineer or buy. Simply connect up the incoming a-c line and outgoing d-c cables and you are in business. Over 450 such Westinghouse units are rendering outstanding service.

Selenium Rectifiers furnish small blocks of d-c power

Westinghouse selenium rectifiers are the answer to your need for small amounts of d-c power. All you do is skid the unit to the working face, plug in the a-c current on one side and take d-c power off the other. The unit contains all the necessary apparatus in one compact package.

Which equipment will do the best job for you?

Remember, continuous mining starts with continuous power. Your Westinghouse representative can help you attain better production by studying your electrical needs and recommending the units best suited for your operations. Call him or write to Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa.

J-94999

YOU CAN BE **SURE**...IF IT'S

Westinghouse

240 tons hourly at Red Parrot Mine

Tournarocker is chute-loaded with 15 tons of slate and bone coal in 18 seconds. Rig was driven to Prenter from Charleston (35 miles) under its own power.

Arriving at dump, Tournarocker backs to edge of bank. Big 4-wheel air brakes, plus front-wheel drive, give operator confidence for fast dumping, maneuvering.

1 "C" Tournarocker

Coal miners today are working many seams never before considered practical — thanks to new techniques in drift-mining and refuse-removal. Take the two Red Parrot Coal Company seams near Prenter, West Virginia, for example. Here's how they operate:

Red Parrot (division of North American Coal & Dock Corp., Cleveland, Ohio) removes coal from the mine in 2½-ton cars . . . dumps it into a "rope and button" conveyor running to the tipple and washer. Refuse — mostly slate and bone coal — is conveyed to an overhead bin several hundred feet above the plant. Then . . . to complete the company's time-saving, labor-saving mechanization . . . Red Parrot hauls refuse from bin to dump with a C Tournarocker. Production records show this *one* 18-ton Rear-Dump does the work of *three* 6 to 8-ton dump trucks on the refuse-removal operation.

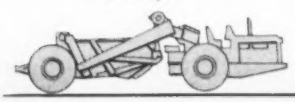
16 loads per hr. on 3000' cycle

Working 2 shifts a day regardless of weather, Tournarocker is chute-loaded at the bin with

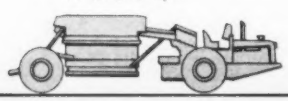
INTERCHANGEABLE FOR EXTRA PROFITS

Same prime-mover is readily interchanged for use with scraper, bottom-dump, flat-bed, or crane. Assures year-round profits.

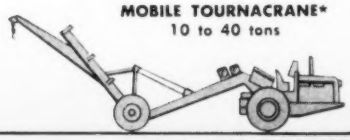
TOURNAPULL* SCRAPER
7 to 42 yds.



BOTTOM-DUMP TOURNAHOPPER*
18 and 27-yd.



MOBILE TOURNACRANE*
10 to 40 tons



*Trademark Reg. U.S. Pat. Off.

Tournarocker speeds from conveyor bin to dump in 3rd gear with full load of refuse. After 2,000 hours operation, owners report 98% mechanical efficiency.

does work of 3 trucks

15 tons of slate and bone coal in an average of 18 seconds. It hauls 1500′ to the dump in 1 minute 24 seconds . . . dumps in 6 seconds . . . and returns to the bin in 1 minute 20 seconds, for an average speed of 12.6 m.p.h. Rig completes the 3000′ round trip in 3 minutes 6 seconds . . . makes 16 trips per 50-minute hour. Hourly production averages 240 tons. No wonder Outside Superintendent F. Mason Morgan says, "We are well pleased. Tournarocker works better than any rubber-tired equipment we've used." He adds, "Operator efficiency is up, too."

Get facts for your work

Whenever you have rock, ore, or shovel-dirt to move, your best bet is Tournarocker. Available in sizes from 9 to 50 tons, 122 to 450 h.p. Constant-mesh transmission, torque converter, electric body heating unit, are optional. See your LeTourneau Distributor for factual job reports on work like yours. Let him arrange to show you rear-dump Tournarockers at work in your area.

Rocker body tips to vertical, dumps instantly, clear over bank. Requires less clean-up, reduces cycle time. Rig's simple, sturdy design (no frame, no sub-frame, no springs, no hydraulics) saves on maintenance, too.

Tournarocker—Trademark Reg. U.S. Pat. Off. R-218 CM ww

TOURNAROCKER BULLETIN illustrates in detail the many mechanical advantages of this Rear-Dump unit. We will be glad to send you a copy for your files. Drop us a line.

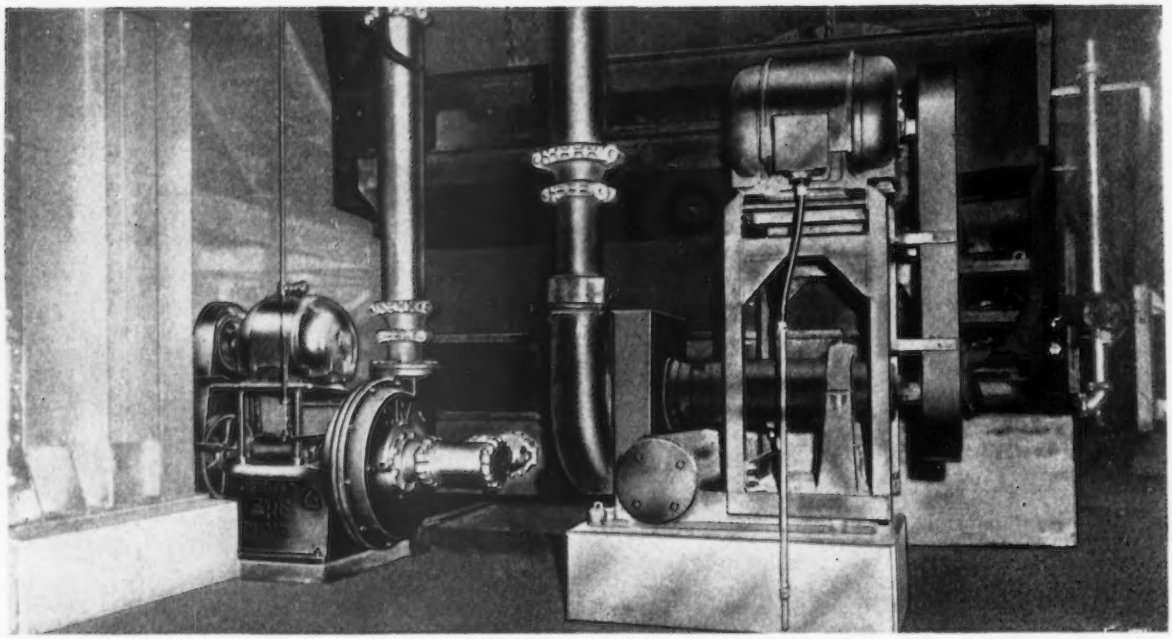
LETOURNEAU LET EQUIPMENT

R. G. LeTOURNEAU, INC.

Peoria, Illinois

DENVER SRL PUMPS

Complete Milling Equipment—from testing, to feeder, to dryer!



This is a graphic illustration of the efficiency and comparative size of Denver SRL Sand Pumps. The 6"x6", 15 h.p. Denver SRL Sand Pump on the left replaced a 6" sand pump (on the right), now used for standby, only. The Denver SRL Pump handles 2,000 tons of classifier overflow per 24 hours, at 45% solids.

Long Service By Denver SRL Sand Pumps Means Less Maintenance Time, More Profits

Long service life and low maintenance on Denver SRL Sand Pumps mean maximum, continuous production and more profits. One to four years of continuous service, with original parts, on —⅛" pulp or below is common with these Denver pumps. This long, profitable service is possible because the rubber lining in Denver SRL Sand Pumps resists abrasion, cuts, tears and blisters.

SPECIALLY BONDED RUBBER LINING

Rubber linings and runners of the Denver SRL Pumps are specially bonded to steel skeletons by an exclusive pressure molding process. This process prevents the resilient, wear-resistant rubber from pulling away from the skeleton forms. You thus have wearing parts with up to 50 times longer life than parts of hardest alloy iron. The high resilience of the rubber is important. Passage of tramp up to 3" without stalling the pump has been reported. Rubber can even be punctured without efficiency loss.

HIGH EFFICIENCY, LOW HORSEPOWER

Pressure molding on all parts is extremely accurate so you get maximum efficiency. Efficiency is as high as 70%, which is 1½ to 3 times the efficiency possible with cast parts of ordinary iron or steel. Generally the Denver SRL Sand Pump requires less than one-half the brake horsepower required by other sand pumps in similar service.

SIMPLE CONSTRUCTION

There are less than 25 main parts in this pump. Operation and maintenance are easy. Rubber casings and runners are quickly changed so standby pumps are unnecessary. The pump requires very little sealing water.

Write or wire today. Find out how you can increase your profits and get more economical, efficient, longer, continuous service with a Denver SRL Sand Pump — sizes 2"x2" to 10"x8", capacities up to 2,500 g.p.m. @ 60% solids, stock deliveries subject to prior sale.

Free Technical Bulletin Sent on Request

Over 25 years of Flotation Engineering

DENVER EQUIPMENT COMPANY

1400 SEVENTEENTH ST. DENVER 17, COLORADO

You can haul more pay-dirt with MANCHA STORAGE BATTERY LOCOMOTIVES

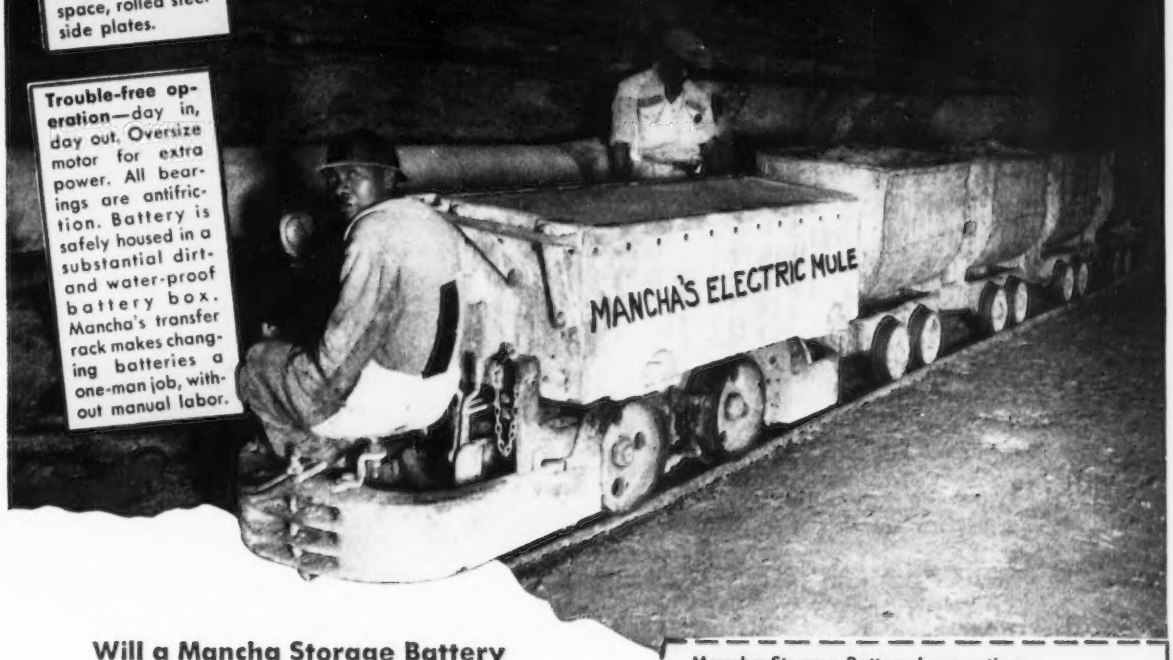
Built for heavy loads, long hauls

Patented Trackmaster design "levels out" rough track—prevents derailment and lost time.

Safety for the motorman—cast steel end cabs with rounded bumpers, extra large cab space, rolled steel side plates.

Trouble-free operation—day in, day out. Oversize motor for extra power. All bearings are antifriction. Battery is safely housed in a substantial dirt- and water-proof battery box. Mancha's transfer rack makes changing batteries a one-man job, without manual labor.

In mines all over the world, Mancha locomotives are maintaining haulage schedules that mean extra profit for their owners. Powerful enough for heavy loads, narrow enough for work in restricted areas, these "Electric Mules" operate efficiently, dependably, safely—wherever there's track.



Will a Mancha Storage Battery Locomotive pay in your mine?

Whether or not you are in the market for new haulage equipment . . .

YOU CAN HAVE THE ANSWER NOW!

Mail the coupon today for our "mine haulage questionnaire." Return it to us with your answers to the questions, and we will tell you if a Mancha locomotive will save you money as it does daily for scores of mine operators.

We make a complete line of storage battery locomotives for all classes of service.

Mancha Storage Battery Locomotive
Division GOODMAN Manufacturing Company
4850 South Halsted Street, Chicago 9, Ill., U.S.A.
E&MJ-653

Send Your Mine Haulage Questionnaire.

NAME.....

FIRM.....

ADDRESS.....

CITY.....ZONE....STATE.....

MANCHA STORAGE BATTERY LOCOMOTIVE
Division GOODMAN *Manufacturing Company*
4850 SOUTH HALSTED STREET CHICAGO 9, ILL., U. S. A.

SPEED where it saves you most

Here a Bucyrus-Erie drill pounds out hole on a copper mining operation. Derrick head shock absorber protects machinery from vibration — reduces cable wear by keeping shock loads down. A Bucyrus-Erie "first" the rubber shock absorber is the most successful yet devised.

Bucyrus-Erie blast hole drills have a nation-wide record for ramming holes down fast—and cheap. A brief rundown shows why—

Big 5⅝ to 12-in. holes—quick— The right balance of tool travel distance, tool weight, and blows per minute — combined with an unmatched rock shattering snap at the impact point — put these rigs "holes ahead" in penetration speed.

Quick moves — Long, sure-footed crawlers mean fast, easy rolling over rough ground — positive traction up 30 percent grades.

Rapid set-ups — Hydraulic leveling jacks (standard on 50-T; optional on 29-T) eliminate elaborate ground preparations, blocking and cribbing. Built-in stabilizing jacks (on the 22-T, 27-T and 29-T machines) provide time-saving 3-point setups even under adverse ground conditions.

Close-grouped controls — Easy handling levers are positioned close together for convenient reach. A driller can run this rig at top speed for long periods without slow down. Built-in tool wrenches (on all except 22-T) safely speed tool changing.

For fast, profitable operation standardize on big hole, fast hole Bucyrus-Erie drills. Four models—5⅝ to 12-in. hole capacities.

6B53

BUCYRUS-ERIE COMPANY

South Milwaukee, Wisconsin

- **All maintenance points are easy to reach.**
- **Can be taken down and returned to service in less than a half hour.**
- **Many parts interchangeable between different pump sizes.**

Here's a pump that maintenance men like. The Allis-Chalmers solids handling pump is solidly built to stand rough solids handling service. And it's easy to work on. Notice how accessible the packing gland is. See how the casing bolts are arranged. Just loosen the nuts a couple of turns and the bolts lift out.

Wearing parts separate into easily handled units. In fact, one man can tear down an Allis-Chalmers solids handling pump, replace a part and have it back in action again *in less than a half hour.* Piping need not be disturbed unless the casing is replaced.

COMPLETE PUMPING UNIT FURNISHED

This pump is equipped with *Texrope* V-belt drive and *Vari-Pitch* sheaves. Head and capacity can be varied instantly by the turn of a crank. Allis-Chalmers can furnish the complete pumping unit — pump, motor, control and drive — assembled and ready to run.

GET THE COMPLETE STORY

Every Allis-Chalmers solids handling pump is application-engineered by a specialist who knows solids handling equipment problems and how to solve them. Your nearby Allis-Chalmers representative will be glad to give you complete facts and figures on CW pump performance. Or write Allis-Chalmers, Milwaukee, 1, Wisconsin and ask for Bulletin 52B6381. A-3975

Texrope and *Vari-Pitch* are Allis-Chalmers trademarks.

NOW

...even longer wear

Impeller and suction wear plate now made of *Ni-Hard* alloy at no extra cost. You get longer wear . . . lower pumping costs.

A-C ALLIS-CHALMERS

ALLIS-CHALMERS

AN UNBEATABLE COMBINATION—

G-300 WAGON DRILL MOUNTING + 70-NDC DRIFTER

Combine the drilling speed from the hard-hitting, strong-rotating CP 70-NDC Drifter . . . and the stability of the lightweight but rugged tubular chassis and drill carriage of the G-300 Wagon Drill mounting. Together they form a perfect team to assure faster drilling from every angle.

The CP Wagon Drill has a specially designed feed motor and cone-gear drive with plenty of power, yet sensitive control, to keep the bit in correct striking position. A tubular "H" drill support insures rigidity, cuts down vibration. The complete flexibility of the unit with its ground hugging characteristics enable it to conform to terrain irregularities. For more information write for Bulletin 876. *Chicago Pneumatic Tool Company, 8 East 44th Street, New York 17, N. Y.*

Chicago Pneumatic 8 East 44th Street, New York 17, N. Y.

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES • ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

IDEAS at work...cutting costs!

P&H Electric Shovels

Progress doesn't come by standing still! And many users of P&H Electric Shovels have learned (to their great benefit) of the strides made to cut costs in all kinds of open pit work.

How has P&H done it? Higher electrical efficiency results from equipment designed and built by P&H specifically for electric digging. Stepless power regulation gives smoother operation with none of the old contactor troubles. P&H Magnetorque* Hoist Drive gives you snappier dipper action—lasts the life of the machine. Air-filtered cab protects all electrical equipment. Independent propel permits faster move-ups. All-welded construction of rolled alloy steels provides the husky strength to withstand years of continuous shock loads.

These and many other advancements, still exclusive with P&H, mean steadier, faster digging. That, in the final analysis, means lower tonnage costs. If that's what you're looking for . . . P&H is your answer.

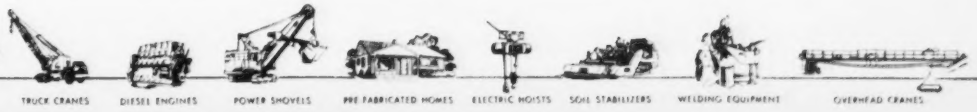
*T. M. of Harnischfeger Corporation for electro-magnetic tybe coupling.

P&H LARGE EXCAVATOR DIVISION

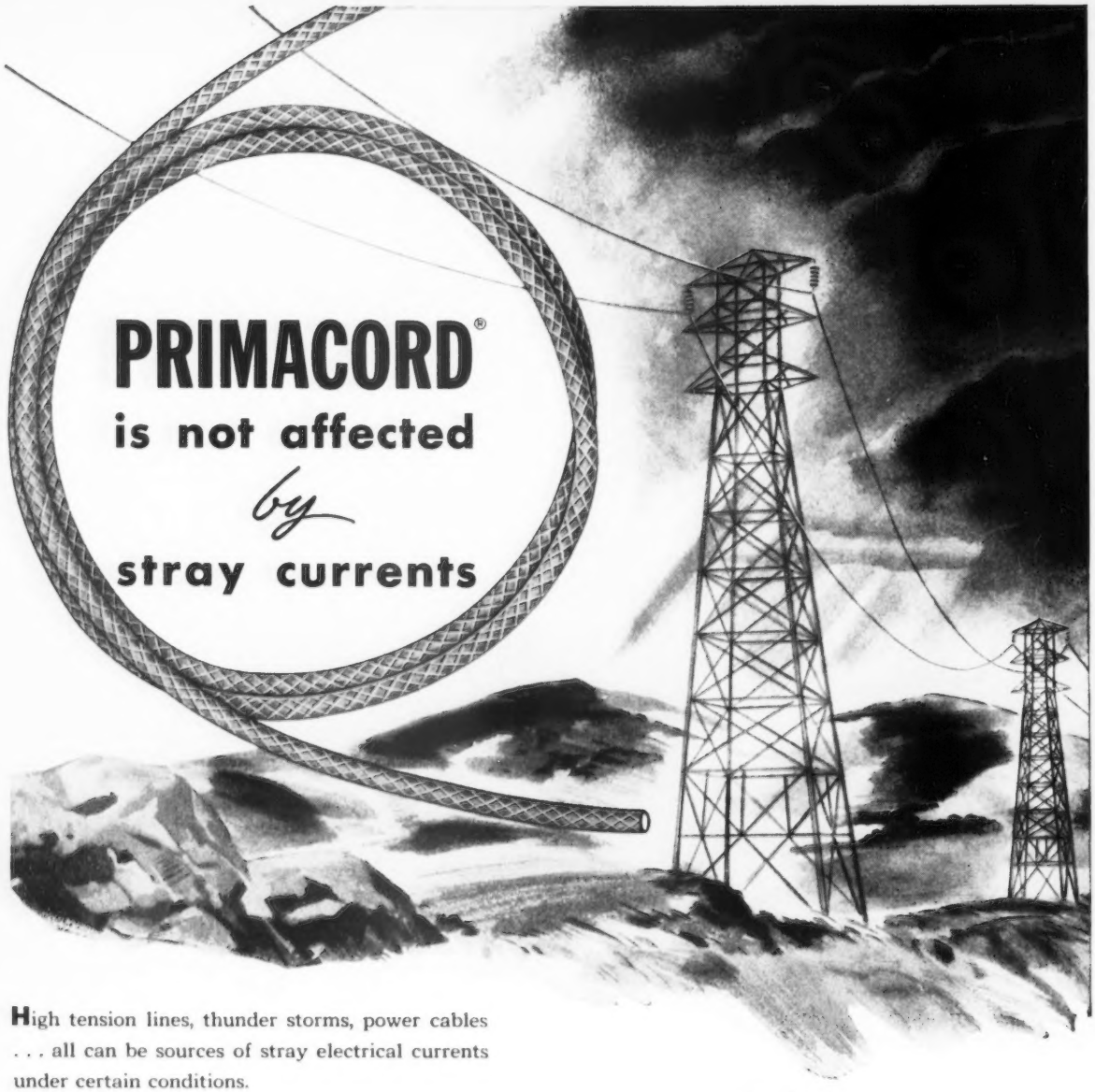
HARNISCHFEGER CORPORATION

MILWAUKEE 46, WISCONSIN

the P&H *Line*



TRUCK CRANES · DIESEL ENGINES · POWER SHOVELS · PRE FABRICATED HOMES · ELECTRIC HOISTS · SOIL STABILIZERS · WELDING EQUIPMENT · OVERHEAD CRANES



High tension lines, thunder storms, power cables . . . all can be sources of stray electrical currents under certain conditions.

When blasting you can guard against them by using Primacord as the primary detonating agent because Primacord is not affected by stray currents, nor can it be set off by friction, sparks, or ordinary shock. It must be detonated to produce the powerful explosive wave which travels at approximately 4 miles per second throughout its length.

Use Primacord from top to bottom in each hole, and to connect all holes. You'll get good shots with more work from your explosives, easier digging and better output.

* * *

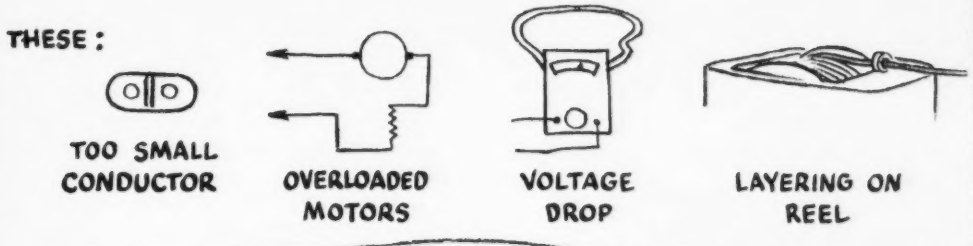
Reinforced Primacord for trunk lines and deep holes where extra tensile strength and resistance to abrasion are desirable; Wire Countered Primacord for deep, ragged holes and high abrasive conditions; Plastic Reinforced Primacord for very deep, wet holes, river crossings, etc.; Plain Primacord for surface trunk lines and shallow holes. P-54

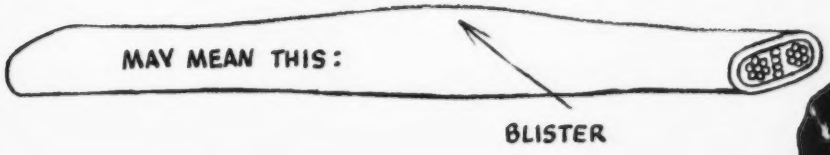
The Ensign-Bickford Company
Simsbury, Connecticut

PRIMACORD®-BICKFORD DETONATING FUSE

Also Ensign-Bickford Safety Fuse — Since 1836

HOW TO SPOT DAMAGE FROM CURRENT OVERLOAD . . .





. . . AND WHY THERE'S GREATER HEAT STAMINA IN ANACONDA'S NEW MINING MACHINE CABLE

Blisters, formed by gases from overheated installation, are a sure sign of cable overloading. A torn cable may result. Since you can't always control overloads, it's important to choose *quality* cable.

Today, due to better design, jackets and insulation, good cables shouldn't cook on the reel the way they used to. But this only makes overloads harder to detect. They still may be present . . . caused by too small a conductor, overloaded machines, voltage drop or even layering of the cable. With 4 layers on the reel, according to I.P.C.E.A., unventilated bottom layers lose 65% of capacity.

WHY THE NEW ANACONDA CABLES ARE SAFER

First, they are more flame-resistant. Jacket is made from a new neoprene formula. Improved cold-rubber insulation gives greater heat stamina. Patented breaker strip* insures a safer ground. No ANACONDA Cable has ever failed a U. S. Bureau of Mines flame-test!

CABLE LIFE NOW MUCH LONGER

In 15 mines recently surveyed, ANACONDA Cables on shuttle cars are lasting up to 300% longer than cables made only a few years ago. Together, jacket and insulation protect these cables better — especially in wet mines where sliver-cuts can cause shocks. The cables are tougher. New-type stranding flexes better under tension.

All this means economy because *one* break in cheap cable costs more than you can save by buying on price. For a sample of this new cable, call your Anaconda Sales Office or Distributor. *Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y.* 53302

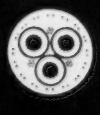
ANACONDA®

TODAY'S HEADQUARTERS FOR MINE CABLE

*U. S. Patent No. 2,466,773

FLAT-TWIN CABLES FOR: shuttle cars, continuous miners, loaders, cutters, drill trucks

HI-VOLT CABLES FOR: mine power



TYPE SH-D FOR: shovels

TYPE SO FOR: hand drills, remote control

TROLLEY WIRE
FEEDER CABLES
TELEPHONE WIRE
SHOT FIRE CORD
WELDING CABLES

Loading sand on construction job.

PRODUCTION UP COSTS DOWN

Loading rock in Eastern quarry.

Tough loading jobs that incorporate loading of sand, rock, frozen ground, narrow passage ways, long hauls to discharge or any combination of disagreeable and hard to manage operations are easy for an Eimco.

These heavy-duty machines are at home in a rock pile — they'll load big or small trucks and operate in a space where no tractor can turn around.

Write for information on Eimcos, how they can load for you at unusually low cost and at a rate of 250 to 350 tons per hour.

You Can't beat an Eimco

EIMCO A456

THE EIMCO CORPORATION

The World's Largest Manufacturers of Underground Rock Loading Machines

EXECUTIVE OFFICES AND FACTORIES — SALT LAKE CITY 10, UTAH, U. S. A.

BRANCH SALES AND SERVICE OFFICES:

NEW YORK, 51-52 SOUTH STREET • CHICAGO, 3319 SOUTH WALLACE STREET
BIRMINGHAM, ALA., 3140 FAYETTE AVE. • DULUTH, MINN., 216 E. SUPERIOR ST.
EL PASO, TEXAS, MILLS BUILDING • BERKELEY, CALIF., 637 CEDAR STREET
KELLOGG, IDAHO, 307 DIVISION ST. • LONDON W. 1, ENGLAND, 190 PICCADILLY

IN FRANCE, SOCIETE EIMCO, PARIS, FRANCE
IN ENGLAND, EIMCO (GREAT BRITAIN) LTD., LEEDS 12, ENGLAND
IN ITALY, EIMCO ITALIA, S.P.A., MILAN, ITALY

Construction job in frozen ground.

EXCLUSIVE FEATURES MAKE EIMCOS

1st Choice to Cut Loading Costs

Eimco has always been first to provide low cost economical loading equipment. Among the features that make Eimco first choice with all users of these machines are:

1st to use simplified construction. Eimco uses from 40% to 60% fewer parts in construction.

1st to use alloy steel castings throughout. Eimco is the only loader with main castings made of alloy cast steel.

1st to build in safety features. Eimco's design incorporated 15 or more protective features for benefit of the operator.

1st to provide a coupler for your car. In spite of the fact that couplers are an essential factor in loading speed, Eimco is the only manufacturer who designs and builds a special coupler to fit each customers car.

1st to provide full loading of your car. Eimco, through selective assembly, is the only manufacturer that can tell you you'll get your car loaded full all the way back and mean it.

1st to provide buckets engineered to your muck and car. It takes a special bucket to do a special job.

1st to supply a machine that tunnel contractors could use to help them establish world tunneling records.

And 1st on many other important features that make and keep Eimcos the leading rock loader.

You Can't beat an Eimco

EIMCO A455

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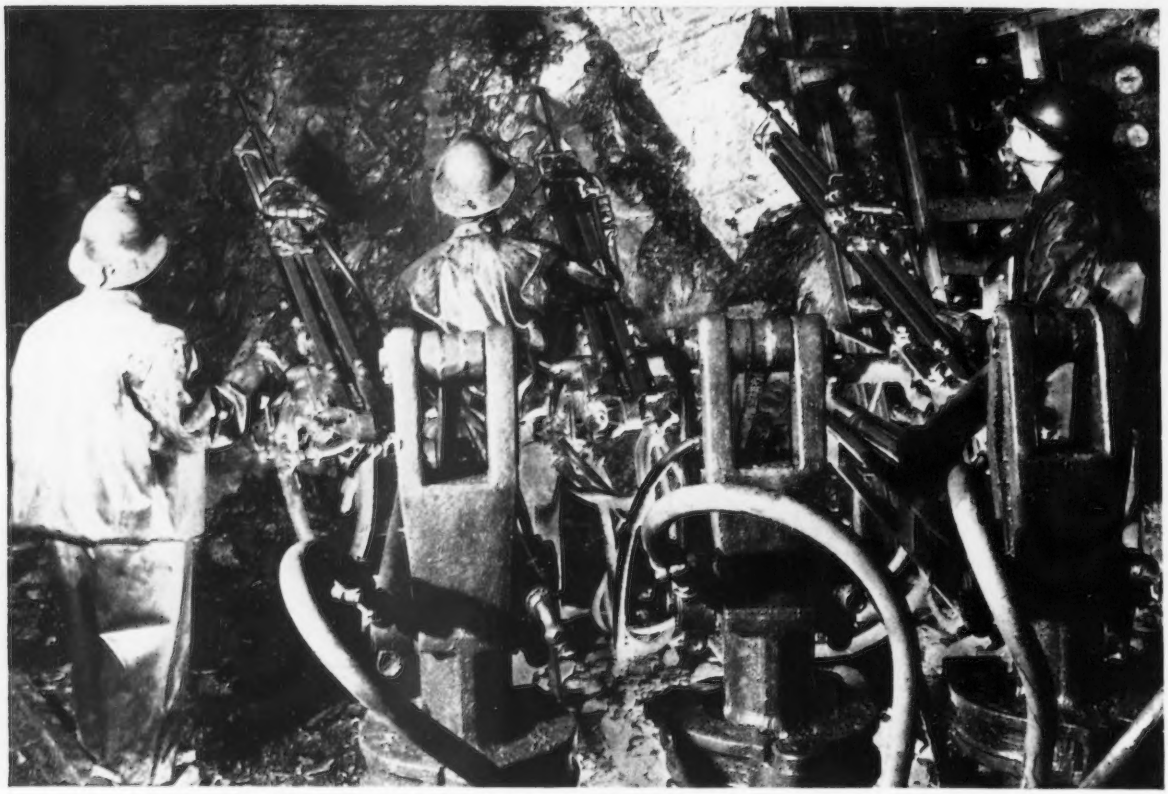
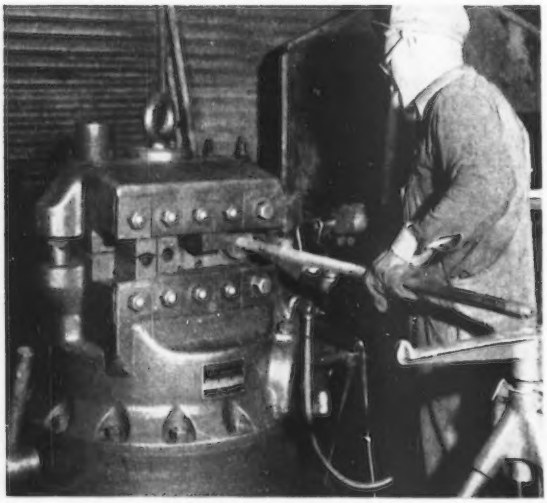


This mobile jumbo mounts three drifters for drilling a fast round in the footwall slate as headings are advanced on the 2,400-ft level. Carbide-tipped bits and Bethlehem hollow drill steel are relied on to keep the job on the move.

Driving an 8,800-ft drift to open up large tonnages of Marquette ore



The sharpener operator shanks a 1-in. quarter-octagon rod in the well-equipped drill steel shop operated by the Mather Mine.

Photos courtesy of H. H. Korpinen, Superintendent, Mather Mine

A substantial increase in the production of iron ore at the Mather Mine depends on a newly-driven drift which connects the famous A and B shafts located at Ishpeming and Negaunee, Michigan. Being driven from two headings on the seventh level, 2,400 ft below the surface, the main level drift makes it possible to turn cross-cuts under sizable ore bodies.

Drilling, blasting, and mucking were carried on at a fast pace from the time the project was begun in early 1951. From start to finish, they have relied on Bethlehem hollow drill steel to help keep the drilling on schedule, both in this vital haulage tunnel and elsewhere at this property.

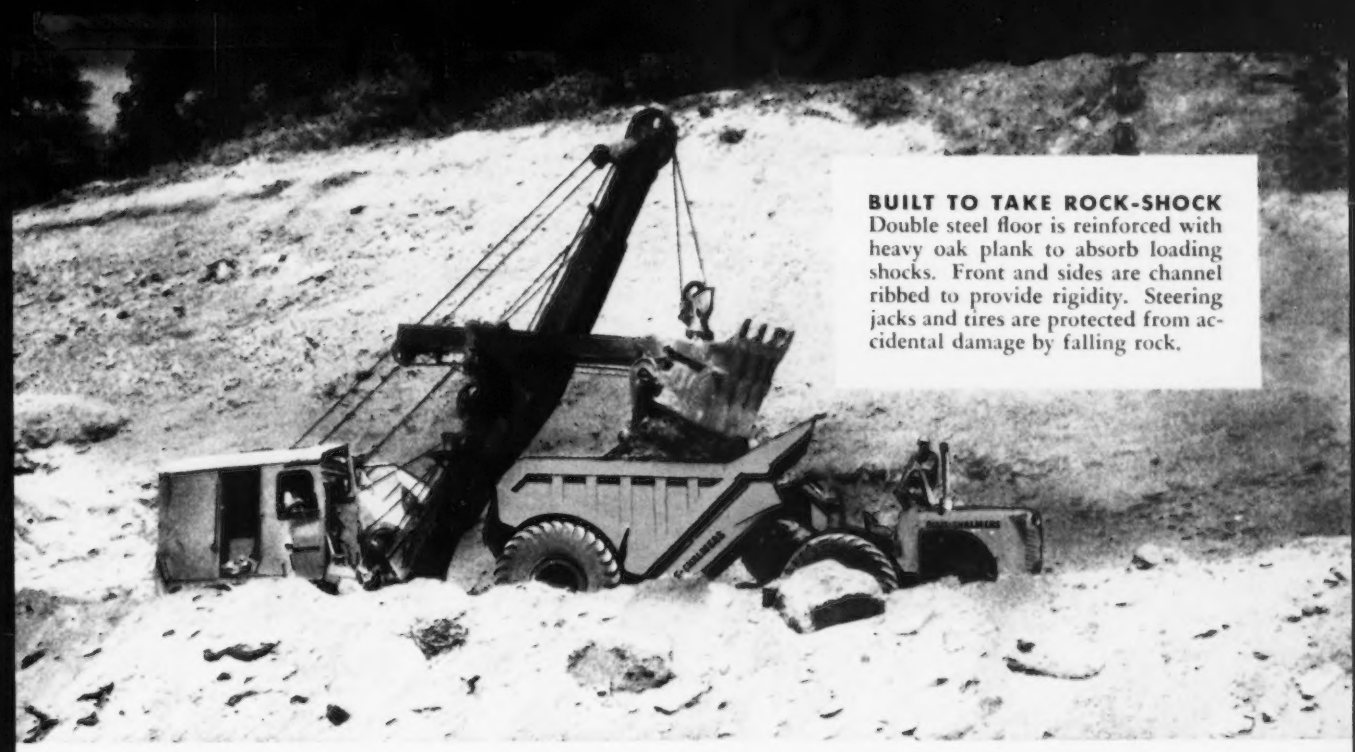
Output of iron ore at this mine totalled 1,635,256 tons in 1951. Production in 1952 reached 1,701,343 tons, an all-time record for the Marquette Range. The management expects the mine ultimately to reach an annual capacity of 3 million tons.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM HOLLOW DRILL STEEL



BUILT TO TAKE ROCK-SHOCK
Double steel floor is reinforced with heavy oak plank to absorb loading shocks. Front and sides are channel ribbed to provide rigidity. Steering jacks and tires are protected from accidental damage by falling rock.

modern, high-production demands call for

Allis-Chalmers Motor Wagon

built to meet today's high production demands

DUMPS SAFELY . . . CLEANLY — Wheel base remains constant during entire dumping cycle. With this stable wheel base, operator may back to the very edge of a steep fill, set the powerful air brakes on *all four* wheels and put the entire load over the edge.

Clean interior, plus high, 70-degree tilt assures complete load ejection. Body may be heated by exhaust to prevent freezing of materials in severe temperatures.

MULTIPLY TRACTOR USE WITH INTERCHANGEABLE SCRAPER BODY . . . for stripping and other self-loading operations. TS-200 Motor Scraper is a high-speed, rubber-tired unit with 13-yard capacity, "through-the-center" boiling action for easy loading, positive forced ejection and many other high-production features.

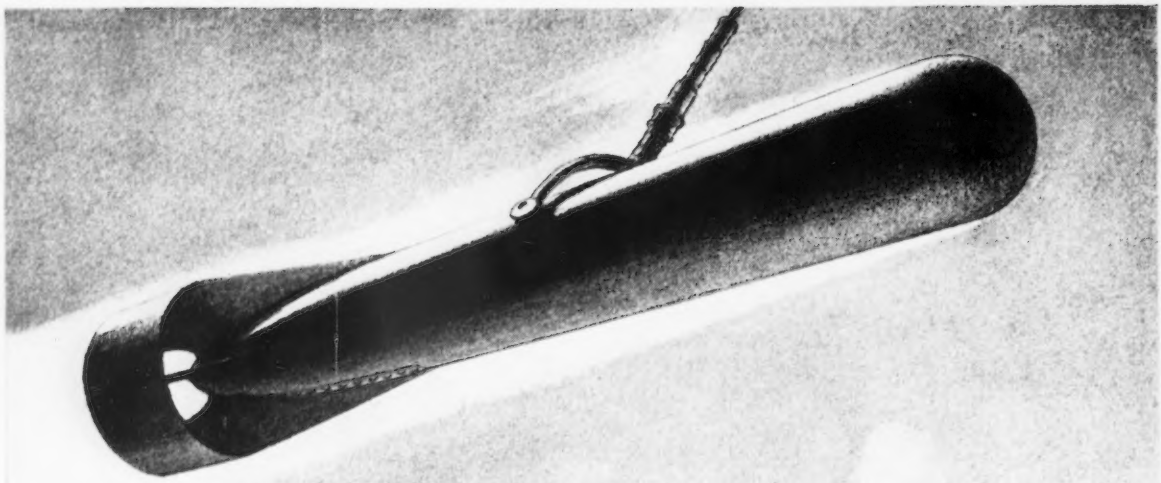
Ask your Allis-Chalmers dealer for the full story.

TRAVELS FAST — High horsepower-to-yardage ratio and large, high-traction rock-lug tires give fast average travel speeds — even on adverse grades and heavy going. Delivers more loads per hour; reduces idle shovel time.

ALLIS-CHALMERS MODEL TR-200 REAR-DUMP MOTOR WAGON

Choice of Engines—165 hp. Cummins; 176 hp. Buda.
Capacity — 15 cu. yd., heaped; 18 tons.
Speeds — Five forward to 21.6 mph.; reverse to 2.5 mph.
Hydraulic steering and dumping.

ALLIS-CHALMERS
TRACTOR DIVISION · MILWAUKEE 1, U. S. A.



Explorers at Work ...

Flying swiftly over all kinds of terrain, AERO surveyors are helping to uncover big new finds of iron, chrome, titanium and other minerals with the airborne magnetometer.

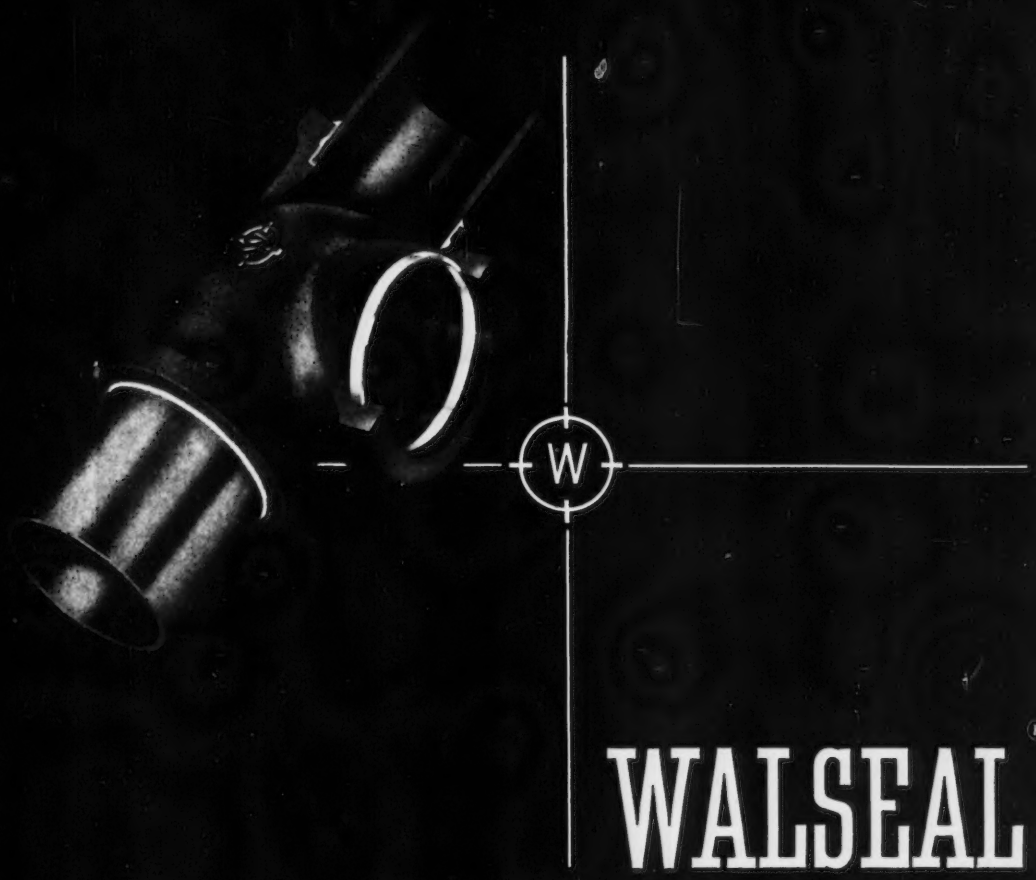
Why is the economical air method playing so important a part in so many jackpots? Because it covers the whole area, with no gaps . . . no omissions. Ground surveys can be made only where a man can walk, but AERO maps easily over muskeg, jungle, and all types of rugged terrain. In AERO's experienced hands the high sensitivity Gulf magnetometer delivers the full magnetic record, leading your ground parties to promising areas *years faster.*

When you plan your next survey, consult AERO engineers, and get the benefit of aerial exploration experience which is now approaching a million miles!

AIRBORNE MAGNETOMETER SURVEYS
PRECISE AERIAL MOSAICS
TOPOGRAPHIC MAPS
PLANIMETRIC MAPS
RELIEF MODELS
SHORAN MAPPING

CANADIAN AERO SERVICE, LTD., OTTAWA *is our affiliate*

AERO
SERVICE CORPORATION
PHILADELPHIA 20, PENNSYLVANIA
Oldest Flying Corporation in the World

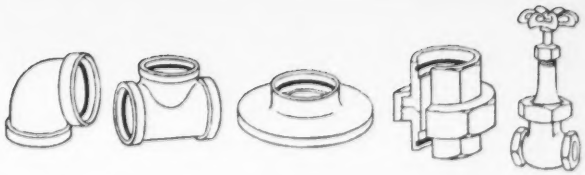


WALSEAL®

COMPLETE LINES OF WALSEAL VALVES AND FITTINGS

WALSEAL is a smooth-bore, bronze valve or pipe fitting having a **factory-inserted** ring of silver brazing alloy in the outlet or outlets. The brazed joint that results when a Walseal product is installed is leakproof, vibration-proof, and corrosion resistant. The alloy fillet that appears upon completion of the joint is visual assurance of **full penetration of alloy.** This improved method of joining brass, copper, or copper-nickel pipe or tube is another Walworth contribution to the progress of the valve and fittings industries.

In addition to its complete line of Walseal products, the Walworth Company manufactures complete lines of valves, fittings, unions, and flanges in a wide range of sizes and temperature-pressure ratings. The company also makes three lines of pipe wrenches, the Genuine Stillson, Walco, and Parmelee. Walworth products total approximately 50,000 items and are sold through distributors or agents in all parts of the world.



The sectioned Walseal tee illustrated, shows: (a) the fillet of alloy that appears upon completion of the Walseal joint. This fillet is your visual assurance of complete penetration. (b) the factory-inserted ring of silver brazing alloy. (c) sectioned view of the completed Walseal joint showing penetration of alloy both ways from the insert. Walseal joints can be made only with Walseal valves or fittings. For further details regarding Walseal products, ask for Circular 84.

WALWORTH

Manufacturers since 1842

valves . . . fittings . . . pipe wrenches

60 East 42nd Street, New York 17, N. Y.

SEE OUR CATALOG IN SWEET'S

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

READY-MADE

Solutions to SPECIAL Dust Problems

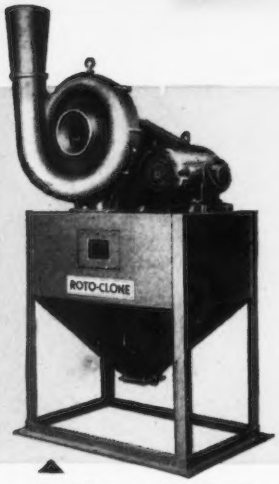
ROTO-CLONE'S WIDE RANGE OF DESIGNS PERMITS TAILORING SYSTEM TO YOUR SPECIFIC NEEDS AT STANDARD EQUIPMENT COST.

We know from 20 years' experience that no two dust problems are exactly alike. That's the reason for the wide, diversified line of Roto-Clone* equipment pictured here. Every one of these designs was at one time a "special"—tailor-made to solve a specific dust-control problem. Today, they are *standard* items which may be adapted readily and economically to scores of applications.

Every dust problem is still a "special" to AAF engineers—but the solution will likely consist of just that right combination of proven Roto-Clone features which, because they are "standard," means savings to you of both time and money.

Run over your list of dust-producing operations. Pick out the "problem child" of the lot, then call your local AAF representative. From our 20 years' experience and the world's most complete line of dust-control equipment, we're certain to come up with the right solution at the right price.

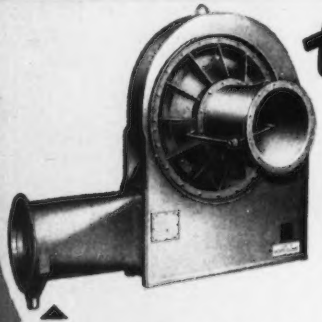
**Roto-Clone is the trade-mark (Reg. U. S. Pat. Off.) of the American Air Filter Company, Inc., for various dust collectors of the dynamic precipitator and hydro-static precipitator types.*



Type D mounted on hopper which serves both as storage container and separating chamber for removing dust from secondary air circuit.

type D ROTO-CLONE

This dynamic precipitator combines the functions of exhauster and dust separator in a single unit. Its wide acceptance as a dry collector of granular process dust is due to many factors—ease of installation, compact design, trouble-free performance and uniform high efficiency in dust separation.



Type W, Arrangement A. Designed for lighter dust loads, it features smaller space, high collection efficiency and lowest cost.

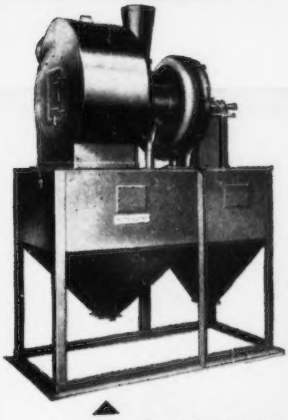
type W ROTO-CLONE

A dynamic precipitator which, by the addition of a moving water film on the collecting surfaces, extends its high cleaning efficiency to the collection of the lightest and finest dust particles, eliminates wear from abrasion and delivers the collected dust as a sludge for easy disposal or reprocessing.

Type N, Arrangement B, for manual removal of sludge from small capacity Roto-Clones. Sloping side of reservoir speeds cleaning operation.

type N ROTO-CLONE

This hydro-static precipitator obtains its high cleaning efficiency from the scrubbing and centrifuging action in the impellers and thorough intermixing of water and dust-laden air. Water recirculation is obtained without pumps or other moving parts. Removal of the collected material as a sludge or slurry eliminates secondary dust problem.

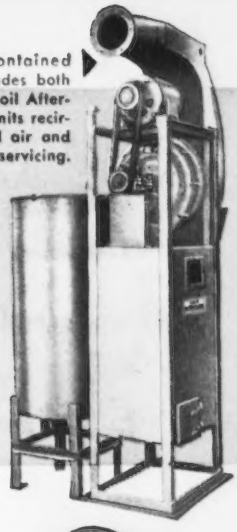


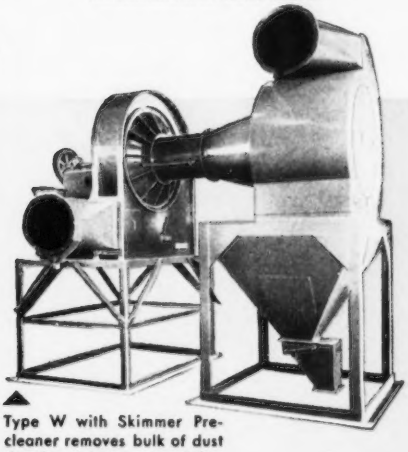
Type D with Skimmer Precleaner for handling exhaust air containing chips or heavy concentrations of abrasive dust.

Roto-Clone Self-Contained Unit exhausts, separates and stores the dust plus filters the air before return to workroom.

Type D with Filter Aftercleaners extends Self-Contained Unit advantages to larger exhaust volumes.

Roto-Clone Self-Contained Unit Model R includes both Precleaner and Cycoil Aftercleaner. Cycoil permits recirculation of cleaned air and requires infrequent servicing.

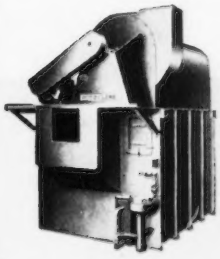




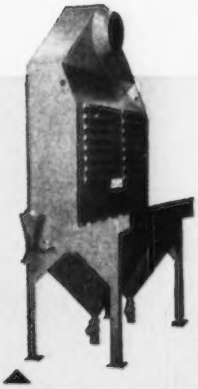
Type W with Skimmer Precleaner removes bulk of dust dry for salvage; remaining fines as sludge or slurry.

Type W, Arrangement D, with Wet Precleaner and hopper designed with sludge drain for continuous disposal of heavier dust loadings as slurry.

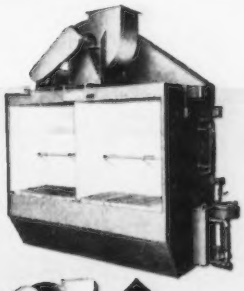
Type W, Arrangement C, with Wet Precleaner and Automatic Sludge Ejector. The most complete dust-control unit ever devised regardless of dust loading.



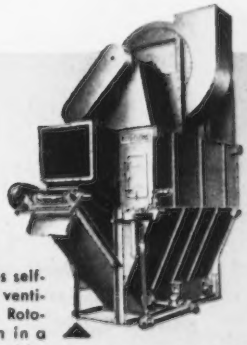
Type N, Arrangement B, for manual removal of sludge from large capacity Roto-Clones. Flat bottom design increases sludge storage space.



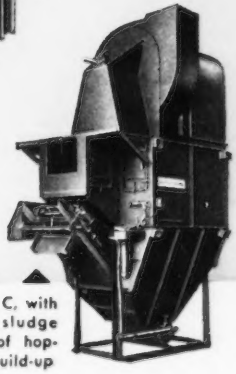
Type N, Arrangement X. Special adaptation of Type N Roto-Clone for collecting explosive dusts.



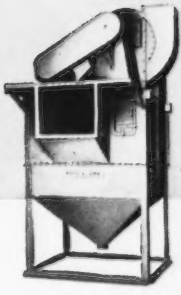
Type N Bench—provides self-contained downdraft ventilated workbench and Roto-Clone dust collection in a single, compact assembly.



Type N, Arrangement C, with Type L automatic sludge ejector is provided in large capacity Roto-Clones to keep overall height to a minimum.



Type N, Arrangement C, with Type W automatic sludge ejector. Steep walls of hopper prevent material build-up



Type N, Arrangement D, with hopper designed for sluicing collected material to process or disposal point.

American Air Filter

COMPANY, INC.

193 Central Avenue, Louisville 8, Kentucky

American Air Filter of Canada, Ltd., Montreal, P. Q. • Pacific Division Office, San Francisco, California

No matter how you look at a Chemico plant

it's a profitable investment

If you are thinking of expanding present facilities or erecting a new plant for the manufacture of heavy chemicals, look into Chemico's all-inclusive service.

PLANNING—All factors that may influence design . . . availability of raw materials and utilities, location of plant site, soil conditions . . . are checked before starting engineering designs. Each Chemico project is planned to meet your specific needs.

PROCESS—Chemico offers a wide range of processes for the production of heavy chemicals. Every one is proved in service . . . designed for maximum output at lowest product cost.

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DELIVERY—Chemico trains the operating crew . . . turns over an efficiently operating plant on a one-contract, one-responsibility, performance-guaranteed basis.

From every viewpoint, a Chemico-built plant is a profitable investment. Proof? 37 years of successful experience in completing more than 300 installations throughout the world.

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A UNIT OF AMERICAN CYANAMID COMPANY

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TECHNICAL REPRESENTATIVES: IN EUROPE—CYANAMID PRODUCTS LTD., LONDON; IN CANADA—CHEMICAL CONSTRUCTION (INTER-AMERICAN) LTD., TORONTO; IN SOUTHERN AFRICA—SOUTH AFRICA CYANAMID (PTY) LTD., JOHANNESBURG

CHEMICO CHEMICAL CONSTRUCTION CORP

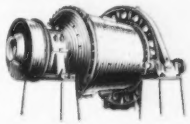
Chemico plants are profitable investments

Allis-Chalmers know-how and equipment have been playing a leading role in the processing of taconite. A-C research laboratory tests, along with pilot plant operations and field work, have revealed valuable data on the processing of low grade iron ore. Crushers, vibrating screens and grinding mills furnished by Allis-Chalmers are already helping to solve the problem of taconite processing on the Mesabi range.

This *unsurpassed* background and experience on taconite, as well as A-C's many years of successful accomplishments on other ores, is available to you when you call an Allis-Chalmers representative. Phone the A-C man nearest you today, or write Allis-Chalmers, Milwaukee 1, Wisconsin.

A-3997

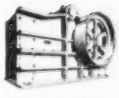
ALLIS-CHALMERS



Grinding Mills

Sales Offices in Principal Cities in the U. S. A. Distributors Throughout the World.

Vibrating Screens



Jaw Crushers

Gyratory Crushers

Hammermills

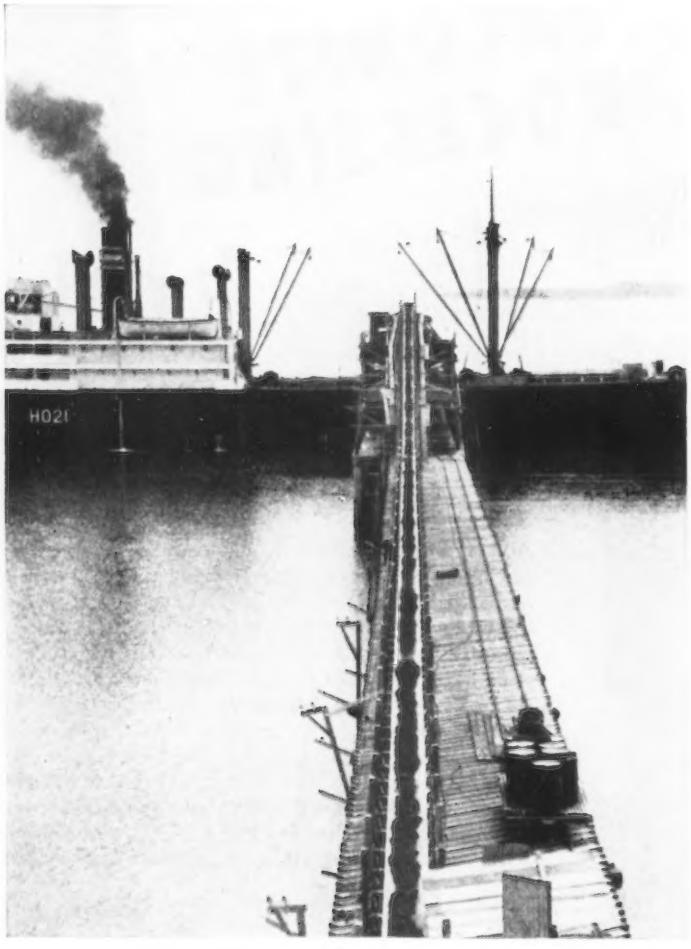
Kilns, Coolers, Dryers

Proof that mining men find it profitable to specify Allis-Chalmers grinding mills is seen in the fact that *7 out of 10* A-C mills sold today are repeat orders!

S-A CONVEYING Systems CUT PORT TIME and COSTS for Ore Ships

Another example of S-A engineering skill at work. Here iron ore is stock-piled continuously and then reclaimed exactly as needed, for loading ships with least delay.

No matter what *your* conveying problem may be . . . Stephens-Adamson engineers have the right answer. They have proved during more than 50 years experience in the bulk materials handling field that their knowledge, plus S-A equipment, gives you the right combination for moving more materials at the *lowest cost per ton*. Write today for complete details!



SAMAR MINING COMPANY
SAMAR, PHILIPPINE ISLANDS

Ore comes 5½ miles by rail car from the mine. A belt conveyor picks it up and stock-piles it by means of an S-A tripper. A second belt conveyor, mounted on a specially built pier, reclaims the ore and carries it out to deep water where boats can dock. At the pier-head a shuttle conveyor discharges into the ships' holds. The system handles about 100,000 tons in a 3-month period, even in the heavy rain typhoon season.

Belt Conveyors
Belt Trippers
Belt, Pan & Plate Feeders
"AMSCO" Steel Pan Feeders
Ship Loading Boom Conveyors
Stacking Conveyors
Storage & Reclaiming Systems
Flight & Chain Conveyors
Screw Conveyors
"Natural Frequency" Vibrating Conveyors
REDLER Conveyor-Elevators
ZIPPER Conveyor-Elevators
Conveyor Belt Cleaners
Headshaft Holdbacks
Grizzlies & Screens
Centrifugal Pilers
Bin Gates & Tunnel Gates
Car Pullers & Spotters
Hoists & Winches
Bucket Elevators
Skip Hoists
SEALMASTER Ball Bearing Units

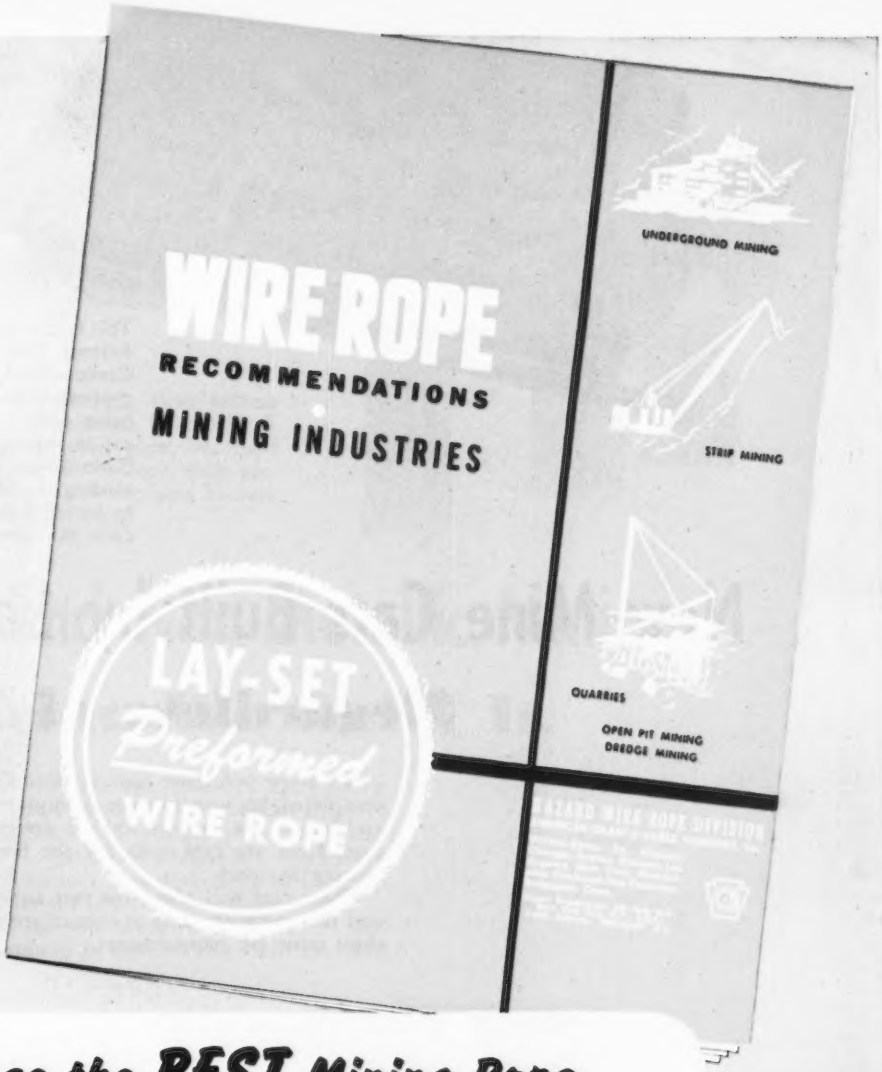
Write for a bulletin on any of the above.

STEPHENS-ADAMSON MFG. CO.

4 Ridgeway Avenue, Aurora, Illinois — Los Angeles, Calif., Belleville, Ontario

DESIGNERS AND MANUFACTURERS OF ALL TYPES OF BULK MATERIALS HANDLING EQUIPMENT

an ACCO product



with this NEW Booklet You Can

Choose the BEST Mining Rope

• This wire rope recommendation booklet in 8½" x 11" size, with large type, tells you the one best wire rope for each piece of mining equipment you operate. It shows big pictures which make it quick and easy to use.

The recommendations are based on the satisfactory results obtained from HAZARD wire ropes for years by mining operators all over the country. You can be sure of longer service life and lower operating costs when you use the HAZARD wire ropes this booklet recommends.

Ask your HAZARD distributor for a copy right away—or use coupon.

ACCO

TRADE MARK

HAZARD WIRE ROPE DIVISION
AMERICAN CHAIN & CABLE

Wilkes Barre, Pa., Atlanta, Chicago, Denver, Houston, Los Angeles, New York, Odessa, Tex., Philadelphia, Pittsburgh, San Francisco, Bridgeport, Conn.

Hazard Wire Rope Division 0000
American Chain & Cable
Wilkes-Barre, Pa.

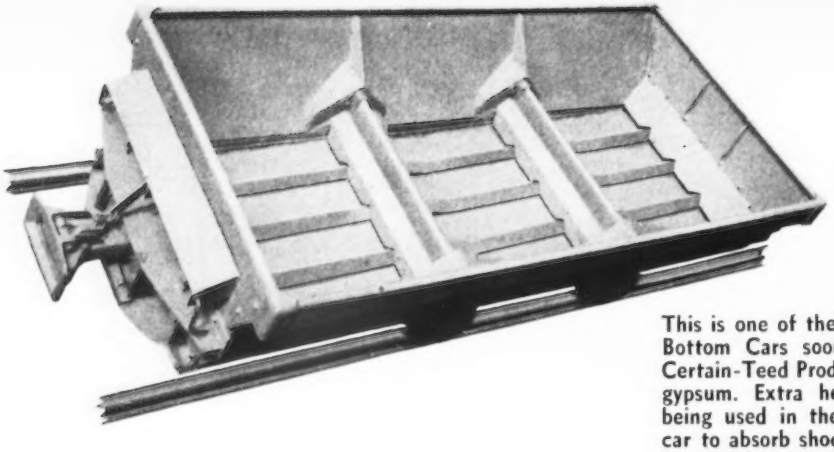
Please send **DH-129-A** "Wire Rope Recommendations for Mining Industries."

Name

Title

Address

Town State



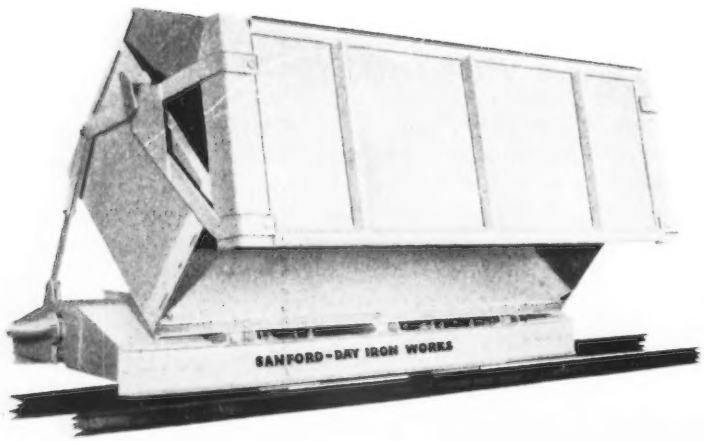
This is one of the S-D Automatic Drop Bottom Cars soon to be installed by Certain-Teed Products Corp. for hauling gypsum. Extra heavy steel plates are being used in the construction of this car to absorb shock loads. It is another Sanford-Day development toward extending the life of cars in tough service, to increase haulage efficiency and reduce maintenance cost.

New Mine Cars Built by Sanford-Day

Regardless of Your Car

We show you these four Sanford-Day Mine Cars, just recently completed, because they are examples of Sanford-Day's experience and know-how in practical car design and dependable construction. Here are cars built for the hardest service known in the mining industry.

These cars will also give you an idea of why so many metal and non-metallic mine operators are turning to Sanford-Day for their mine car requirements.



In many mines the Granby Side Dump Car is the required method of haulage. Here is a Sanford-Day built Granby Car, designed for practical construction, with reinforcing angles and extra supporting members where needed to increase the life and service of the car. This car was built for the LePanto Consolidated Mining Co., Philippine Islands.

SANFORD-DAY IRON WORKS,

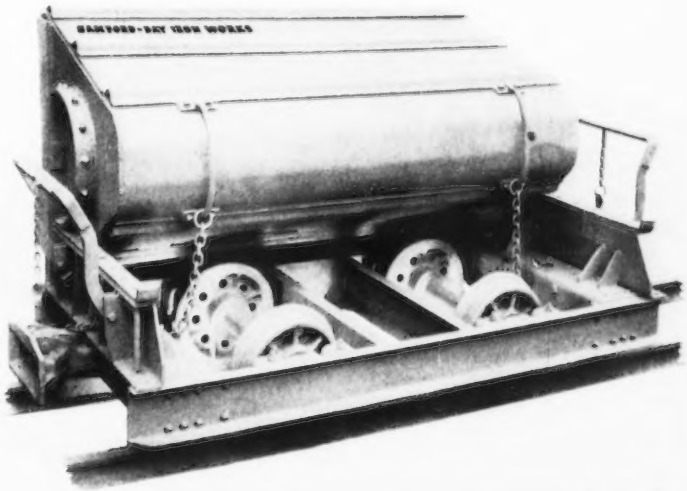
Here is one of the S-D Automatic Drop Bottom Cars to be put in service this year by the U. S. Potash Company at its Carlsbad mine. We built this car of one-half inch steel for heavy duty performance. They will haul potash non-stop because S-D Automatics dump on the move.

for Metal and Non-Metallic Mining.

Requirement, We Build It.

These operators, like yourself, are cost-minded! They know that skimpy fabrication is false economy. Consequently, they are installing Sanford-Day Cars because of their superior construction . . . with extra welding . . . extra rivets and extra reinforcing where extra strength should be . . . cars designed and built up to service requirements for longer life and less maintenance.

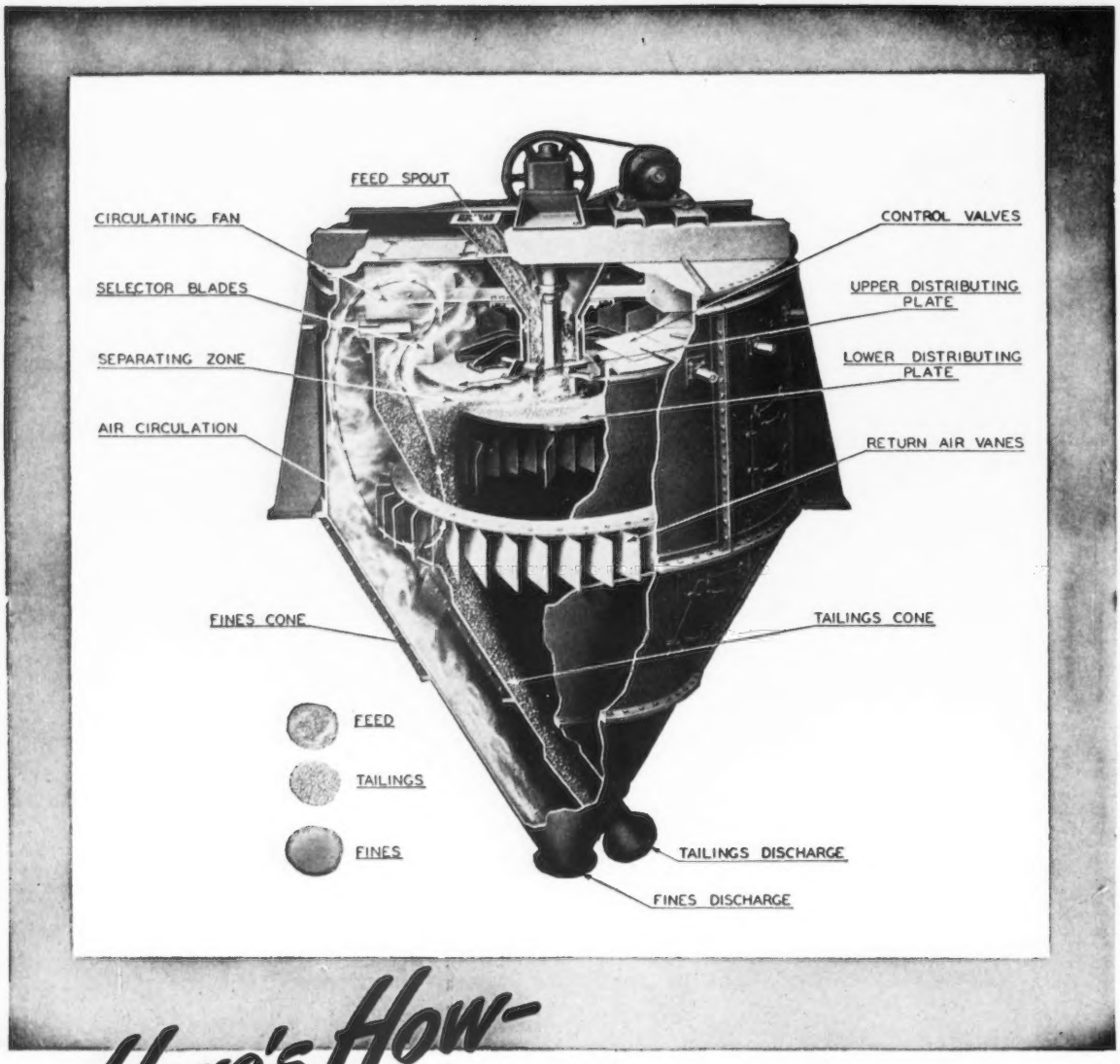
Regardless of the type of car you need, we build it . . . and you'll discover that an investment in Sanford-Day built cars will be money well spent.



We are building S-D Rocker Cars, similar to the one shown here, for several mine operations. In many ore mines where the Rocker Car is the most economical solution to the haulage problem, the Sanford-Day Rocker Car is recognized for its ability to take the extreme punishment required by these cars.

KNOXVILLE, TENN.

After 50 years of leadership in the industry, Sanford-Day still devotes its entire capacity to the production of mine cars. Most improvements in mine cars originate with this company.



Here's How—

STURTEVANT AIR SEPARATORS

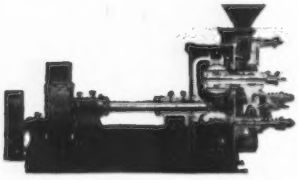
Produce accurate fines with increased output up to 300%

Exact regulation and control of centrifugal forces and air currents, one counteracting and overbalancing the other so precisely that by simple adjustments a product of almost any desired fineness is selected and collected, while coarser sizes are rejected . . . that's the principle of operation of Sturtevant Air Separators.

The benefits you derive from this separator are—increased output by as much as 25% to 300% . . . lower power costs by 10% to 50% . . . reduced maintenance.

A typical on-the-job example is as follows—a 16 ft. separator takes a feed of 750 tons per hour containing only a small percentage of the desired product and delivers 30 tons of material 90%, minus 200 mesh.

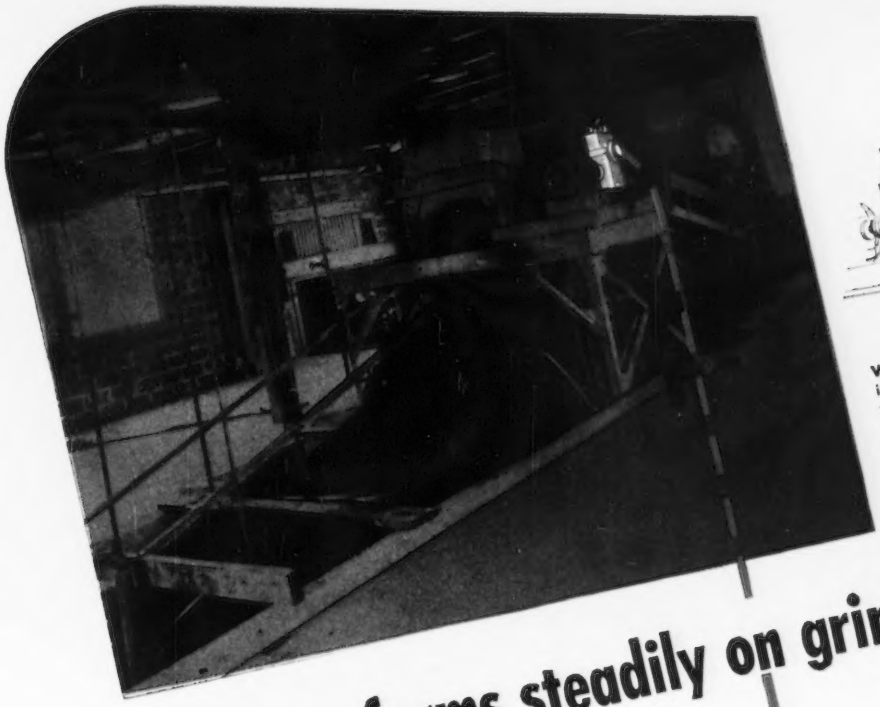
Investigate Sturtevant Air Separators today. Write for information and bulletin.

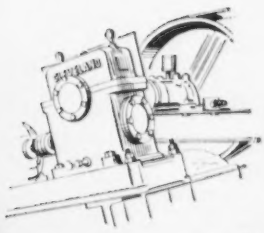


RING ROLL MILL

Capacities from 12 to 18 tons per hour. Range 10 to 200 mesh. Use this mill in closed circuit with Sturtevant Air Separators.

STURTEVANT
MILL COMPANY
101-A Clayton Street, Boston 22, Massachusetts
Designers and Manufacturers of
CRUSHERS • GRINDERS • SEPARATORS • CONVEYORS
MECHANICAL DENS and EXCAVATORS • ELEVATORS • MIXERS





WORM GEARING—universal in its application—affords advantages for almost every power transmission job. Whether you want worm gearing sets or speed reducer units, you will find drives to meet your need in the complete Cleveland line.

CLEVELAND performs steadily on grinding circuit

YOU'RE looking at one phase of an ore grinding circuit. Notice the Cleveland worm gear speed reducer that drives the conveyor belt. Year after year, this Cleveland unit has been helping move heavy chunks of metallic ore from crusher to sizing screen, at the slow, uniform speed required for top production. Never a breakdown. Never an unwanted fluctuation of speed. Once speed is set, it remains set—under any load, under all conditions.

Since its founding in 1912, Cleveland has concentrated its entire engineering and manufacturing effort on one single product—worm gearing. Some of the earliest Clevelands are still operating as dependably as the day they were first installed. No wonder management throughout industry specifies Cleveland so frequently, whenever a right-angle drive is needed.

If you have a power transmission problem, write us. Send for free new Catalog 400. The Cleveland Worm and Gear Company, 3281 East 80th Street, Cleveland 4, Ohio.

Affiliate: The Farval Corporation, Centralized Systems of Lubrication. In Canada: Peacock Brothers Limited.

CLEVELAND
Worm Gear
Speed Reducers

pick up bigger payloads

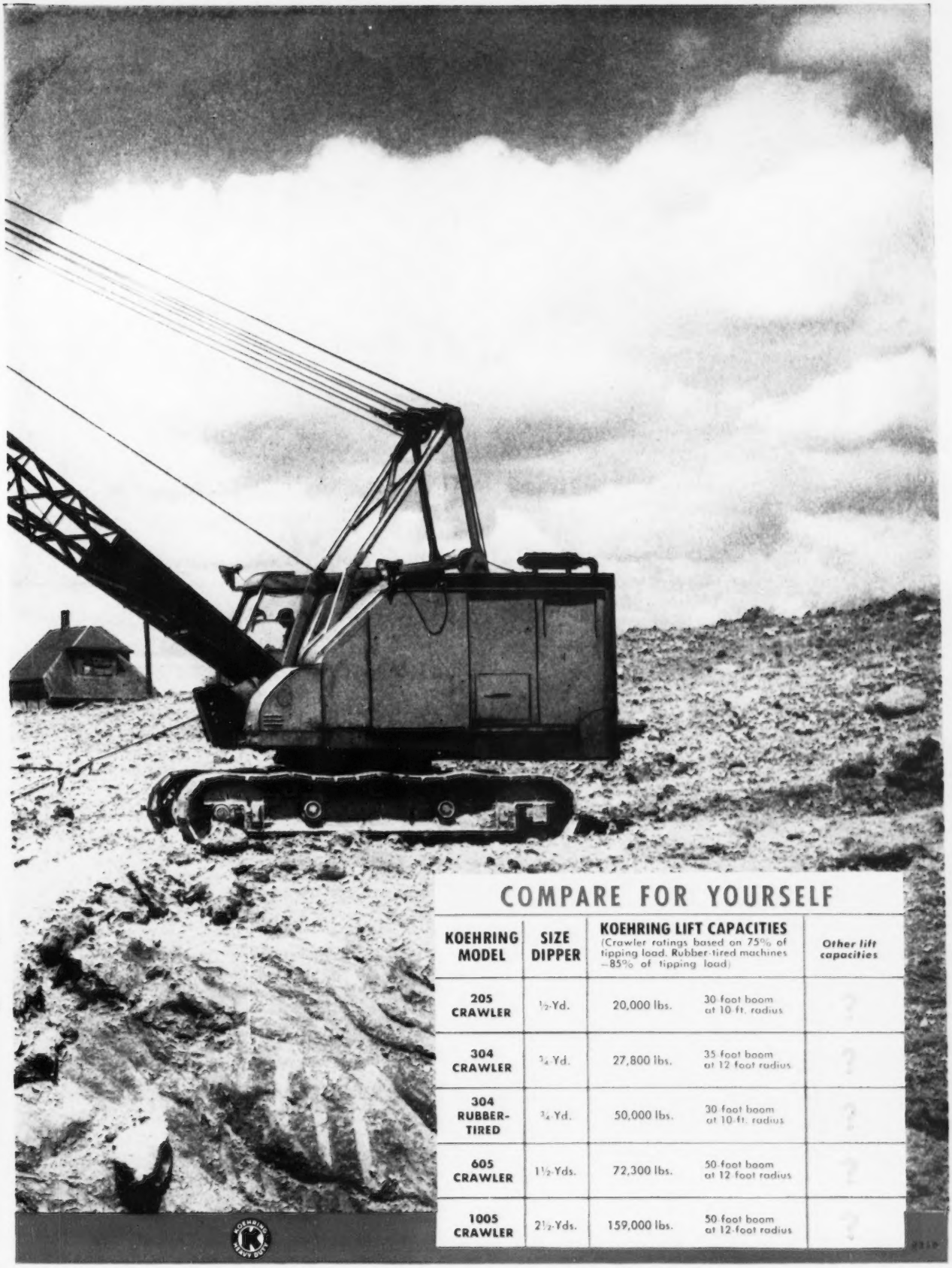
with "KOEHRING WORK CAPACITY"

Big payload performance of Koehring cranes and excavators can be measured very quickly. Take a look at lifting capacities, for instance.

Obviously, the machine with the heaviest lift capacity not only picks up larger crane loads, it also has more power and stability to increase shovel or hoe production — handles bigger dragline and clamshell buckets on a wider work range.

Check lift ratings and other clear-cut measurements of "KOEHRING WORK CAPACITY", to insure biggest payload performance on all of your jobs. See Koehring distributor for all the facts.

KOEHRING COMPANY Milwaukee 16, Wis. Subsidiaries: JOHNSON PARSONS • KWIK-MIX



COMPARE FOR YOURSELF

KOEHRING MODEL	SIZE DIPPER	KOEHRING LIFT CAPACITIES (Crawler ratings based on 75% of tipping load. Rubber-tired machines —85% of tipping load)		Other lift capacities
205 CRAWLER	½-Yd.	20,000 lbs.	30-foot boom at 10-ft. radius	
304 CRAWLER	¾-Yd.	27,800 lbs.	35-foot boom at 12-foot radius	
304 RUBBER-TIRED	¾-Yd.	50,000 lbs.	30-foot boom at 10-ft. radius	
605 CRAWLER	1½-Yds.	72,300 lbs.	50-foot boom at 12-foot radius	
1005 CRAWLER	2½-Yds.	159,000 lbs.	50-foot boom at 12-foot radius	

S—165

Fewer Shifts for Faster Trips

Take a ride in any mechanical-drive off-highway truck. Watch the driver work all the way as he double-clutches, slows down, shifts and speeds up over and over again. He'll be using up to ten transmission speeds to make his run and it'll be tough going all the way.

Now take that same trip in a truck that has an Allison TORQMATIC DRIVE. The driver's left foot will be idle because there's no clutch pedal to push. Notice how he just flicks a lever to shift *without slowing down*. And notice that with the flexibility of the torque converter he needs only three forward speeds to adequately handle all loads and grades. He'll be making fewer shifts and be back for another load a lot faster. Faster trips mean more pay loads per day.

Matched units built by one manufacturer, Allison TORQMATIC DRIVES cut operating and maintenance costs by absorbing harmful shock loads. Ask your equipment manufacturer, dealer or write:

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Unbeatable Team for Maximum Operating Economy

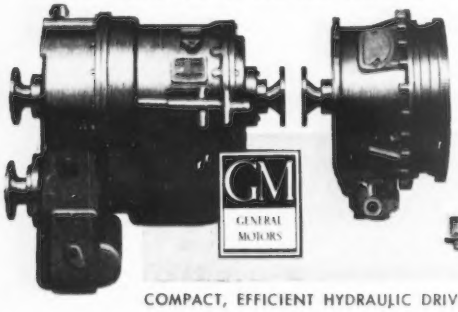
**Quick shifts* at full throttle with fingertip hydraulic control.

**Holds* power to load at all times — no clutch pedal to push — no gearshift guess.

**Cuts* maintenance cost by absorbing shock — eliminates engine lugging — prolongs equipment life.

**Only* torque converter-transmission team designed to work together as a unit and built by one manufacturer.

MATCHED UNITS BUILT BY ONE MANUFACTURER



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is first again!

now it's the "Blast Hole" drill designed especially for percussion deep hole drilling

the NEW Model SFH99

A Natural Partner — with Carbide Bits and Superior Gardner-Denver Alloy Sectional Rods and Couplings — for Low Cost Blast Hole Drilling.

Permits a 4' change in a 7' drift—saves time and development work.

Superior chuck construction—1½" x 3 15/16" shank rod locked in chuck—results in longer life for hammer, tube, chuck, shank rod and ring seal.

Locked-in shank rod prevents loss of rod string on down holes.

Heavy-duty centralizer supports rod string during rod changes—simplifies up-hole drilling.

Reverse rotation and locked-in shank rod enable operator to uncouple rods quickly and easily—using power from the drill and only one wrench.

Delivers high-pressure water or air through chromium plated tube and Ring Seal Shank.

Lightweight aluminum alloy guide shell—reversible for extra life. Movable cone.

Write today for complete details.

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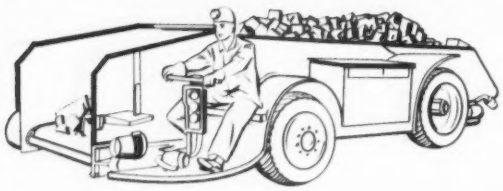
Outstanding benefits of the

Exide-Ironclad

For mine haulage . . . Exide-Ironclad offers



MORE TRIPS PER SHIFT—ample power for fast, steady, high-production haulage. No end of shift slowdown.

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LOW OPERATING COSTS—easy and inexpensive to keep charged, absorbs a very high percentage of charging current, and returns it in useful work.

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WIDE RANGE OF SIZES for all makes of battery-powered locomotives, trammers and shuttle cars.

YOUR BEST POWER BUY
AT ANY PRICE

THE ELECTRIC STORAGE BATTERY COMPANY
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"EXIDE-IRONCLAD" and "SILVIUM", *Reg. T.M. U.S. Pat. Off.*

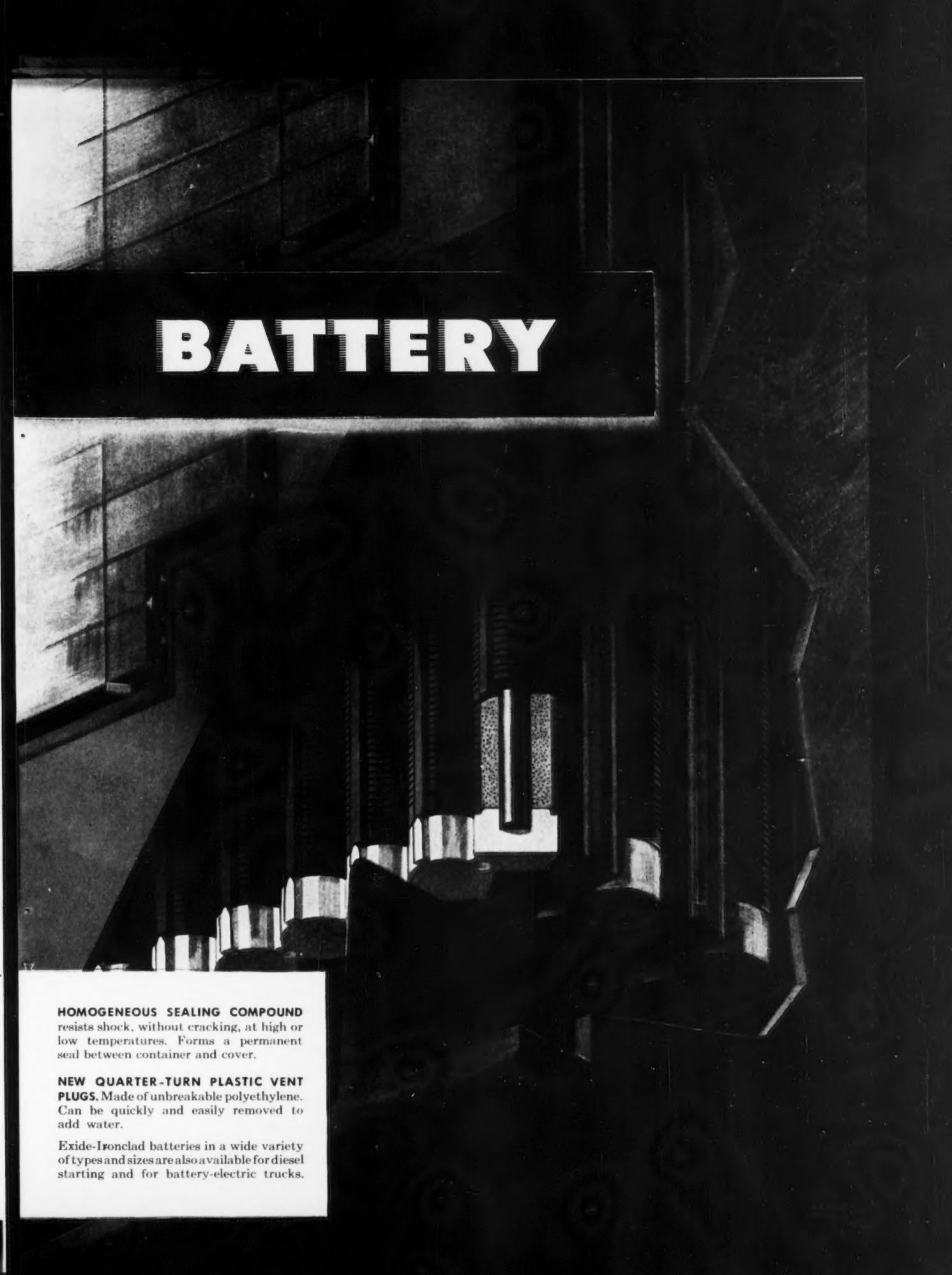
Here's the Inside Story of the EXIDE-IRONCLAD Battery

Inside . . . where it counts most . . . Exide-Ironclad is entirely different from any other battery. It's made that way by the exclusive IRONCLAD slotted tube construction . . . a principle that provides direct operating-hour savings for you.

POSITIVE PLATE SPINES cast with the heavy top bars are of SILVIUM, which resists corrosion . . . contributing to longer battery life.

SLOTTED TUBES retain active material in contact with spines, yet permit the electrolyte to penetrate throughout the active material.

POLYETHYLENE TUBE SEALER. This acid-proof plastic sealer fits snugly into the bottom of positive plate tubes, sealing in the active material for a longer working life.



HOMOGENEOUS SEALING COMPOUND resists shock, without cracking, at high or low temperatures. Forms a permanent seal between container and cover.

NEW QUARTER-TURN PLASTIC VENT PLUGS. Made of unbreakable polyethylene. Can be quickly and easily removed to add water.

Exide-Ironclad batteries in a wide variety of types and sizes are also available for diesel starting and for battery-electric trucks.

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Here's a new catalog you'll surely want. It gives you all the details on Rex Speed Primer Pumps for mining use. Rex offers a complete line of self-priming centrifugal mining pumps in capacities ranging from 4,000 gallons per hour to 90,000 gallons per hour. There are gasoline-powered pumps, electric motor driven pumps and pumps without power arranged for belt drive.

You'll find complete specifications, application information, details on construction and operation plus many interesting application photos. You'll learn why—when it comes to mining pumps—your best buy is Rex. Just mail the coupon.

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SPEED PRIMER PUMPS

THESE REPOINTERS ARE *wear-conditioned*

Because they are AMSCO "Wear-Sharp"* Repointers that stay sharper with use...

Service life plus! The combination of Amsco Manganese Steel and the hardness of AMSCOATING with Amsco Hardfacing electrodes—gives you a tooth that wears evenly and stays sharp longer.

Note that only certain grooves (shown in red at left) are Amscoated—the grooves on the outside and the one on each end. This is the area where ordinary teeth wear fastest. The hardened corners on the "Wear-Sharp" equalize wear along the entire cutting edge and eliminate rounded, blunted corners that cut digging speed and waste power.

Field reports indicate that "Wear-Sharp" repointers will give as high as six times the life of other teeth.

In these photographs at right of a typical case history, old repointers lasted from three to four days. Amsco "Wear-Sharp" repointers lasted 32 days—eight times the service life of the repointers previously used.

"Wear-Sharp" repointers installed on two dipper teeth showing condition of old teeth.

Notice the even wear on these teeth after 257 hours of use with "Wear-Sharp" repointers used. New "Wear-Sharps" are ready for installation.

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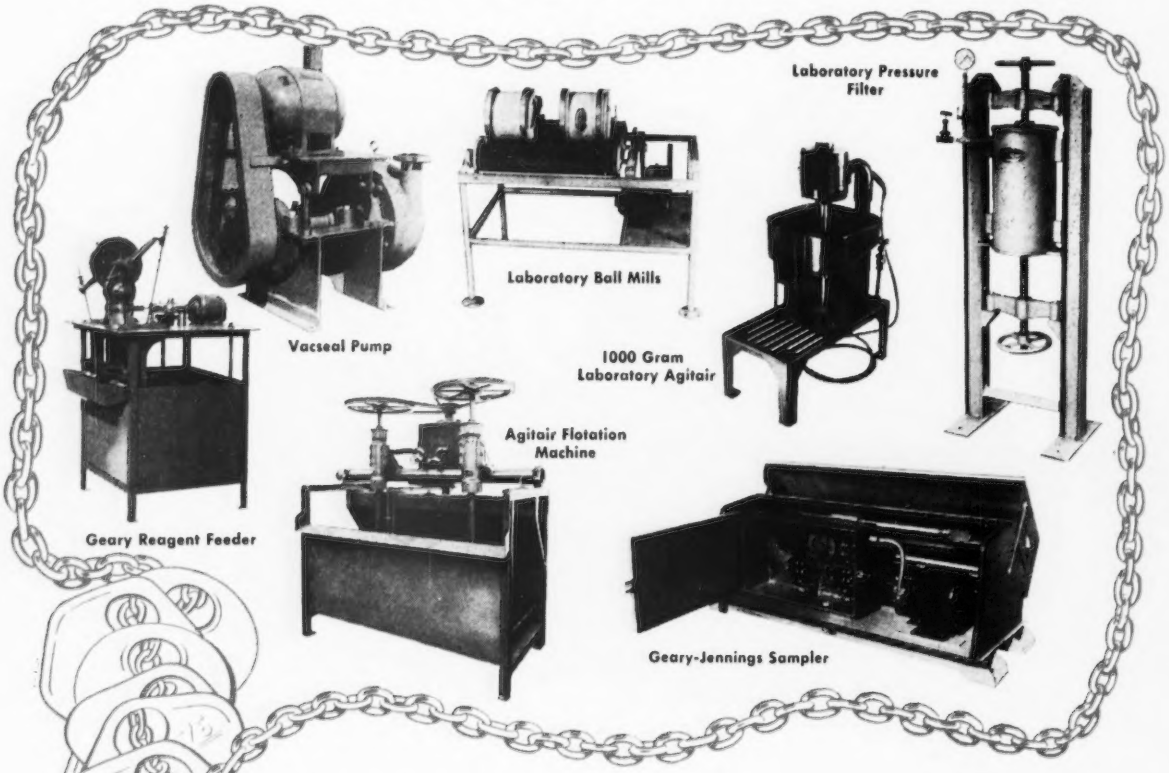
7 keys to sound metallurgy



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With a complete setup of Galigher equipment, any laboratory or mill has adequate and tested tools for ore processing, testing and recovery. Galigher is a name known and accepted in pilot and production plants throughout the world. Whether it is metallurgical experimentation at universities or flow-sheet requirements of the metals industry . . . here is the equipment most highly favored by scientists and engineers.

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Here's the secret of alternate ROCKMASTER® teamed with alternate velocity loading

Alternate Velocity Loading is a newly introduced ROCKMASTER development which has produced astounding improvements in breakage and holds great promise for better blasting in mining, quarrying and construction work.

Every other hole is loaded with low velocity explosives. The balance are loaded with high velocity explosives. The faster ROCKMASTER millisecond delay caps fire the low velocity holes to stress the rock and the next delay interval releases the sharp second punch of the high velocity explosive.

The results of alternate velocity action can be seen in the photo above. The number one holes (which appear larger and lighter colored) were loaded with low velocity Apex and fired with No. 1 ROCKMASTER caps. The number two holes (which appear smaller and darker) were loaded with high velocity Apex and fired with No. 2 ROCKMASTERS.

All holes were initiated from the bottom to prolong confinement of the blast—giving maximum results of the alternate velocity loading.

At present Alternate Velocity Loading is being used only in quarry blasting, but it holds possibilities in many other fields. Talk with your Atlas representative about it. And send for your copy of the new Atlas periodical "Better Blasting" which details *the inside story* of Alternate Velocity Loading.

Absolutely no secondary breaking was necessary on this Alternate Velocity Shot. No. 1 holes show that explosive has worked longer on the burden than the high velocity explosive in the No. 2 holes.

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"Everything for Blasting"

ATLAS POWDER COMPANY, WILMINGTON 99, DELAWARE

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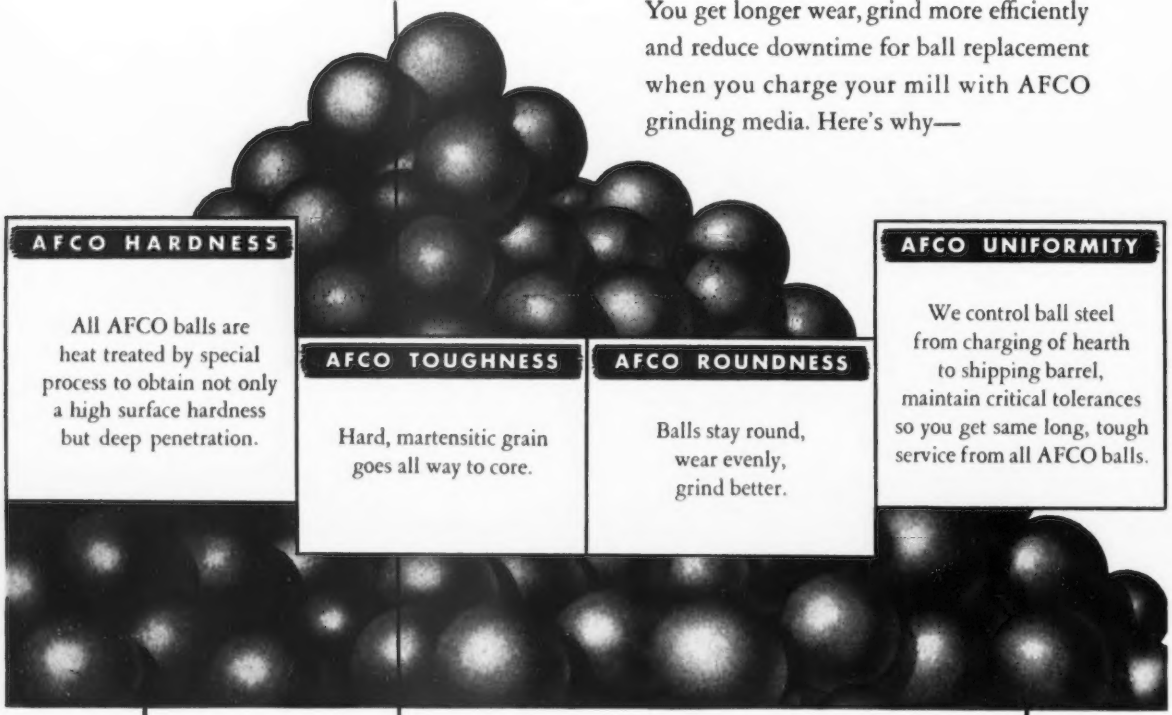
CUT YOUR GRINDING COSTS WITH AFCO FORGED STEEL BALLS

Choice of Chrome-Moly or Carbon Steel ¾" to 5"

You get longer wear, grind more efficiently and reduce downtime for ball replacement when you charge your mill with AFCO grinding media. Here's why—



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Hard, martensitic grain goes all way to core.

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Balls stay round, wear evenly, grind better.

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We control ball steel from charging of hearth to shipping barrel, maintain critical tolerances so you get same long, tough service from all AFCO balls.

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a Doubting Thomas?

IF YOU'RE a man who has to be shown, we're right in your corner. Just give Roebling "Blue Center" Steel Wire Rope one try... see for yourself how it saves time and costs you less on the job.

Two out of three wire rope users in the mining field prefer Roebling rope. Call your nearest Roebling office for a Field Man to suggest the best rope for your purposes.

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A subsidiary of The Colorado Fuel and Iron Corporation

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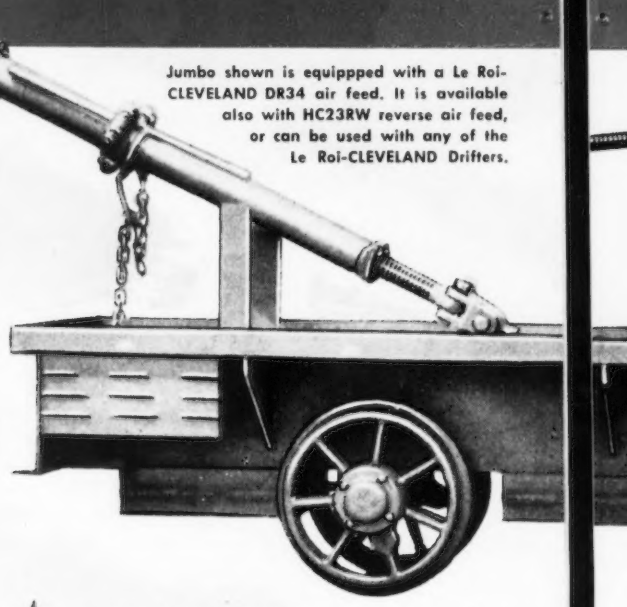
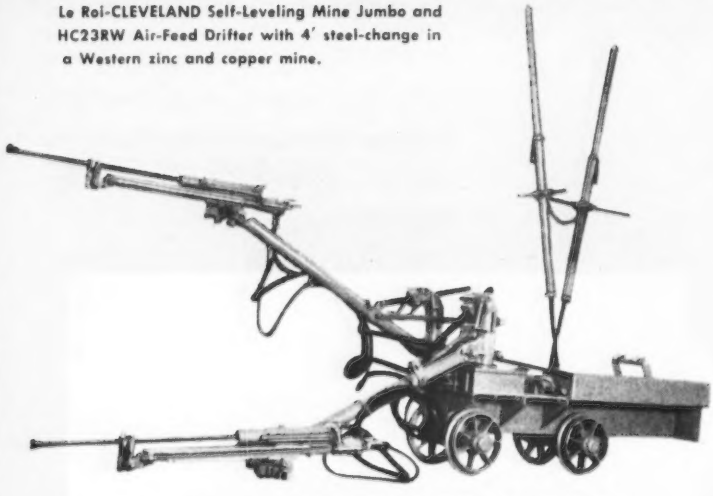
A compact Le Roi-CLEVELAND Air Motor powers the arm of this mine jumbo — miners can take it easier, yet get more done.

Space, Spot,

Jumbo shown is equippped with a Le Roi-CLEVELAND DR34 air feed. It is available also with HC23RW reverse air feed, or can be used with any of the Le Roi-CLEVELAND Drifters.



Le Roi-CLEVELAND Self-Leveling Mine Jumbo and HC23RW Air-Feed Drifter with 4′ steel-change in a Western zinc and copper mine.



Le Roi-CLEVELAND MDR Jumbo

Le Roi-CLEVELAND Jumbos — equipped with air-motor-powered booms — reduce set-up time, drill out the round faster, shorten tear-down time.

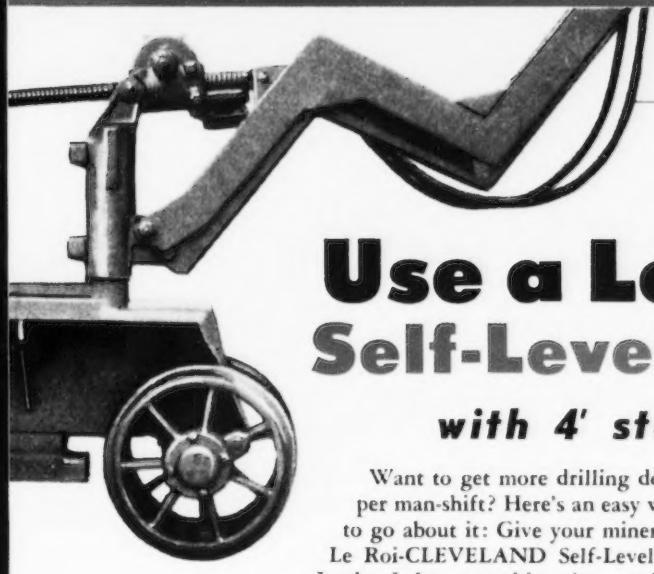
To spot his drifter, the miner simply opens a conveniently located operating valve. Then a powerful, compact Le Roi Air Motor takes over, raising or lowering the boom rapidly to the desired drilling position.

What's more important, the boom stays where it's put. Drifters stay in line — there's no steel binding, no wear-and-tear on chucks. Average drilling speeds are higher.

Write for complete information.

1. Le Roi-CLEVELAND 2-Boom Jumbo with power-feed drifters about to go underground.
2. Six-drill jumbo with Le Roi-CLEVELAND power-feed drifters and air-motor booms mounted on a 1½-ton truck for tunnel job.
3. Le Roi-CLEVELAND Jumbo equipped with long-feed drifters for use with carbide-insert bits.
4. Air-motor-powered booms give fast, solid set-ups. It's mechanically impossible for booms to drift during the drilling operation.

and Drill Holes Faster!



Speed drilling cycles!	*Get better fragmentation!*
Save time drilling lifters!	*Speed loading cycles!*

Use a Le Roi-CLEVELAND Self-Leveling Mine Jumbo

with 4' steel-change Air-Feed Drifter

Want to get more drilling done per man-shift? Here's an easy way to go about it: Give your miners a Le Roi-CLEVELAND Self-Leveling Jumbo. It has everything they need to do the work you want — and cut your costs, too.

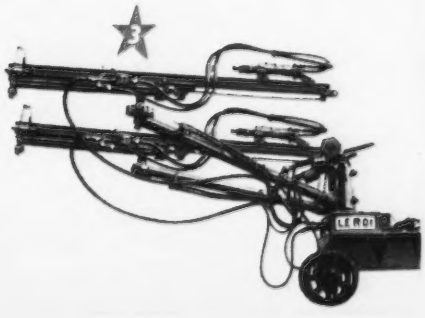
It has a self-leveling air-motor-powered arm. And that means miners can spot and space holes quickly and easily, for the most efficient fragmentation. They don't have to loosen a bolt or tilt a boom, to complete the drilling cycle.

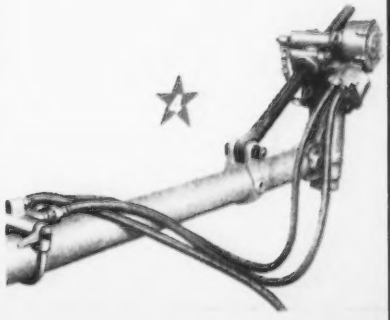
It has an exclusive rigid screw and gearing mechanism that keeps the heading straight, cuts down overbreak and underbreak. It also keeps the drifters in line, prevents the steel from binding, reduces chuck wear.

It has an offset arm that provides plenty of clearance to drill lifters. Miners don't have to take time out to swing the drill under the arm.

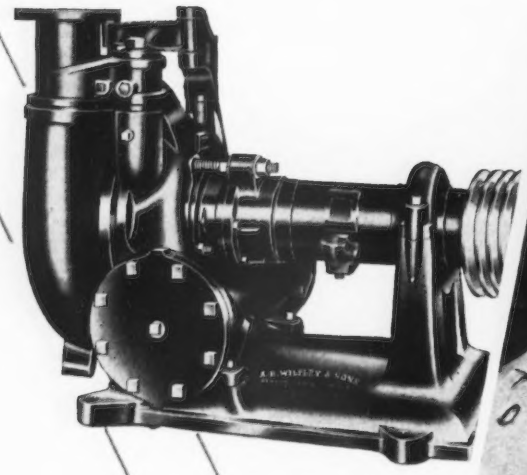
Together, these Le Roi-CLEVELAND features add up to faster cycles, greater tonnage per man-shift, lower costs! And that's why you owe it to yourself to get further information on both the single-arm and double-arm models. Write us today.

CLEVELAND ROCK DRILL DIVISION
Le Roi Company
12500 BEREA ROAD • CLEVELAND 11, OHIO *Plants:* Milwaukee, Cleveland and Greenwich, Ohio

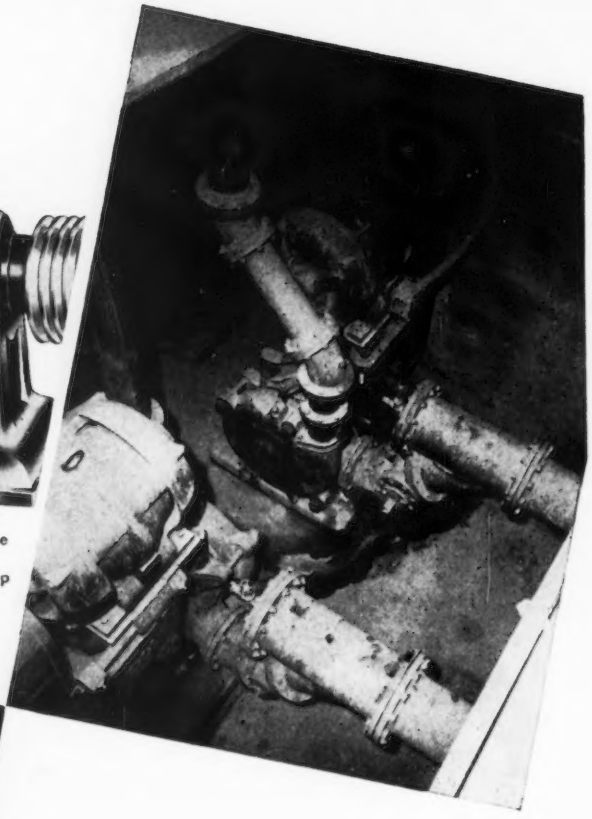




RD 55



Companion to the famous Wilfley Acid Pump



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In cement plants all over the world where slurries, sands or slimes are handled, famous WILFLEY Sand Pumps are delivering continuous, trouble-free performance 24 hours a day without attention. Wherever WILFLEYS are used, the record reveals stepped-up production and cost-saving efficiency. There is an economical WILFLEY pump size for every pumping requirement. Individual engineering on every application. Write or wire for complete details.

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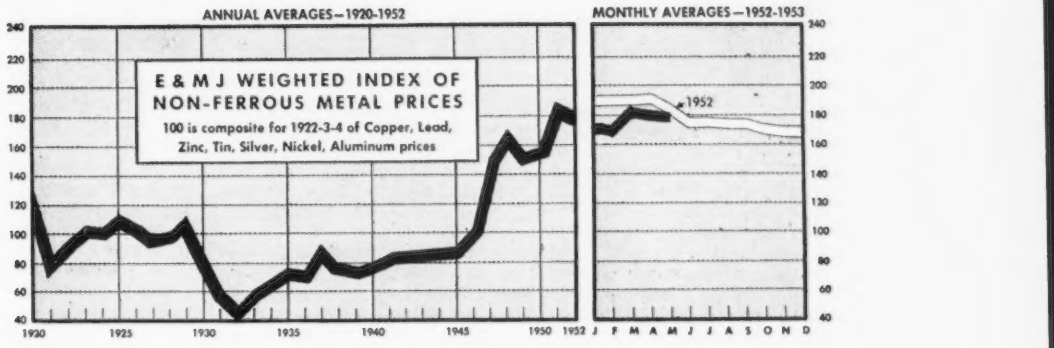
centrifugal PUMPS

E&MJ OUTLOOK

PRICES



MARKETS

Consumption of metals rolls along unchecked, but buyers view the summer months with uncertainty. Consumption for July is bound to drop somewhat, owing to all-plant vacation periods observed almost universally by fabricators. After that, international politics will set the pace.

The *E&MJ* index of nonferrous metal prices eased last month, on lower averages for copper and tin. Lead recovered on sustained buying against June needs; zinc stood pat, awaiting a stronger market outside the U. S. The May index was 181.58, against 182.62 in April.

•

LABOR

That Mine-Mill movie, shooting of which started such an uproar at Silver City, N. M. several months ago, may prove a misfire. It's rumored that not even the union liked it when they saw the final job.

Mine-Mill seems to favor an occupational disease fund clause in any new contracts this year. They'd like John Lewis' coal mine fund idea if they could get it.

•

AT HOME

Despite heartening signs of something almost approaching wisdom in conduct of both government and business these days, it still seems like a good bet that the last half of the year will see a decline in business generally of about 6 or 7%.

Automobile production seems to worry everyone but automobile producers and people who buy cars. Production lines are spinning at an annual rate of 7-million units, far greater than consumption.

Technological note: The churn drill is in for some stiff competition from oil-well-type rotary rigs in open-pit blast-hole drilling. Two Arizona properties are getting up to 46 ft. per hr. with rotary drills where churn drill rigs get about 7 or 8.

Cathodic protection—a process whereby a metal such as zinc is consumed to prevent corrosion of pipelines, steel piers in salt water, and other metal structures—offers a new and substantial outlet for Special High Grade and possibly High Grade zinc.

ABROAD

•

With about four years of pilot plant work behind it, the Sherritt-Gordon ammonia leaching process for nickel-copper-cobalt ores seems in the clear, metallurgically.

Two large mining companies are reported to be very much interested in nickel orebodies they've found at Temagami Lake near Cobalt, Ont.

The unsettled foreign copper market is expected to result in backing up of Chilean copper. Despite earnest efforts here and abroad, copper no longer will sell freely at 35½c. The trend is downward.

MARKETS—Trends and Prices

Metals Moving into Consumption at High Rate—Prices Irregular—Record Aluminum Production

CONSUMPTION OF METALS throughout May continued on about the same high plateau as that of the preceding four months of the year. Though purchases against June requirements were substantial, interest in July forward needs was decidedly limited. Too many uncertainties were hanging over the market for prospective buyers to come to a firm decision on the outlook. Tensions in the international arena continued to limit forward business in metals. Purchasing agents held to the view that the supply situation in major metals, with the exception of nickel, is likely to ease over the remainder of the year.

Steel producers have been operating at higher than 100% of capacity during the first five months of the year and they are beginning to wonder whether the boom can last much longer. Benjamin F. Fairless, chairman of the U.S. Steel Corp., told a gathering of steel executives that the industry is going to find itself with too much capacity "in a very short time." He said the day of inside prices is over and his company intends to meet all competition. Steel companies have been following a cautious buying program in manganese ore and other raw materials for some months.

Price Index Lower

Price movements were irregular. Lead averages were higher, but copper and tin declined. Zinc was unchanged for the third consecutive month. The *E&MJ* index of nonferrous metal prices declined from 182.61 in April to 181.58 in May. A year ago the index stood at 186.88.

Developments in aluminum continue to attract wide interest. The Government has decided to continue with its stockpiling program, to the general disappointment of domestic producers. However, this action was offset by prospects of larger imports from various sources. U.S. production of primary aluminum for March totaled 104,460 tons, a new high mark, topping that of October, 1943, by 10,410 tons. Imports of crude aluminum in the first two months of the year totaled 51,672 tons, with Canada the major supplier.

Two U.S. producers of aluminum will obtain 786,000 tons of primary metal from Canada over the next six years, Nathanael V. Davis, president of Aluminium Ltd. announced late in May. Alcoa is to obtain 600,000 tons and Kaiser Aluminum & Chemical 186,000 tons. Approximately 75% of the total will be delivered in the years 1955 to 1958, inclusive. In addition, independent fabricators are to receive 110,000 tons of aluminum a year from Canada for the next several years.

The price situation in aluminum was unchanged. Producers see increased competition ahead and apparently they are pursuing a policy of keeping prices down to expand the market for finished products.

Hearings in Washington on the proposed sliding-scale import duty on lead and zinc uncovered little not already known to the industry. With the Administration opposed to hurried action on this controversial subject, impartial observers felt that nothing would come of this movement at this session of Congress. Imports of both metals continued at a rate admitted to be abnormally high.

Domestic Copper 30c.

As the month of May ended the domestic market settled on the 30c. delivered basis. On the last business day of the month a small tonnage was sold by a custom smelter at 29¾c., but the quantity was insufficient to influence our average for the day. In brief, sellers encountered no difficulty in disposing of prompt and nearby copper at around the 30c. level. No serious attempt was made to press for forward business under prevailing unsettled conditions. Most observers were moderately bearish on the outlook, holding to the view that consumption is likely to decline in the second half of the year and that imports will remain fairly large, even should Chile run into difficulties because of its stand on prices.

Excepting Chile, foreign producers came down to the U.S. basis on most of their sales in the world market. Though the tonnages moving out of Chile have been large, most of this metal is being absorbed currently by subsidiaries of companies engaged in mining the copper. Outsiders who have been taking Chilean metal on the basis of 36½c. Connecticut Valley purchased the high-priced copper along with liberal tonnages of 30c. copper, all for May and June delivery. The feeling was widespread that this situation cannot continue much longer.

Our Chilean correspondent reports that the Government has sounded European markets and learned that at its prevailing price only small barter deals could be arranged. Europe appears to be well stocked from African and other sources. Italy and France are not interested in Chilean copper except at competitive prices. Small independent producers in Chile have been unable to dispose of either concentrates or blister on the basis of 35½c., f.o.b. Chilean ports.

Fabricators in the U.S. shipped products during April that contained 116,319 tons of refined copper. This compares with 122,980 tons shipped in March and 123,850 tons shipped in February. The decline in use of refined copper was thought to have been caused by increased consumption of scrap by the mills. Stocks of refined copper in the hands of fabricators increased from 319,356 tons as March ended to 342,774 tons on April 30.

Lead Price Advanced

Lead consumption in the U.S. has been holding at a high level, and on a firmer situation in the London market, buyers here purchased good tonnages at rising prices. The price moved up to 13¼c., N.Y., in three one-quarter cent jumps, beginning with May 18. Prompt lead in London advanced sharply for a time on an oversold speculative condition.

Zinc failed to move away from the

Average Prices for May (E&MJ Quotations)

Copper:	
Electrolytic, domestic, refinery	29.683
Electrolytic, export, refinery	29.710
Lead:	
Common, New York	12.750
Common, St. Louis	12.550
Silver and Sterling Exchange:	
Silver, New York, per oz.	85.250
Silver, London, pence per oz.	74.000
Sterling Exchange, "Checks"	281.464
Zinc:	
Prime Western East St. Louis	11.000
Tin:	
New York Straits	97.295
New York, 99% min. (e)	96.295
Gold, per oz. U.S. price	$35.000
Quicksilver, per flask	$195.000
Antimony (E&MJ) (d)	37.970
Antimony, bulk, Laredo	34.500
Antimony, in cases, Laredo	35.000
Platinum, refined, per oz.	90.000
Cadmium (a)	200.000
Cadmium (b)	207.500
Cadmium (c)	215.000
Aluminum, 99% plus, ingot	20.500
Magnesium, ingot	27.000
Nickel (f)	60.000

Domestic quotations, unless otherwise stated, are in cents per pound. Sterling exchange checks, in cents. Quicksilver, per flask of 76 lbs.

(a) Cadmium average based on the producers' quotations.

(b) Cadmium average based on the average of the producers' and platers' quotation.

(c) Cadmium average based on platers' quotation.

(d) Domestic, 5 tons or more but less than carload lot, packed in cases, f.o.b. New York.

(e) Tin content.

(f) F.o.b. Port Colborne, U.S. duty included.

Markets Continued on Page 116

11c. East St. Louis basis, even though galvanizing has not slackened appreciably and die casters have been unusually active. The depressed market reflected a high output here and abroad. Imports have been substantial. Prevailing low prices should result in correcting the demand-supply situation. The London market on common zinc has fluctuated between the equivalent of 8¼c. and 9c. per pound during the last month.

Tin prices abroad fluctuated over a rather wide range, moving with political developments in Korea and other areas in the Far East. The trend was downward and the average price for the month was several cents below that of April.

"Free" Gold Market

The market for free gold was generally quiet, with price movements irregular. Bombay and Buenos Aires sold off. The most active center was Paris, where approximately $2,500,000 a day changed hands. Pick's World Currency Report quotes on free gold as follows, per fine oz.:

	COINS		BARS (12.5 kg.)	
	April 30	May 29	April 30	May 29
NEW YORK, transit	.....	.....	$37.00	$36.95
MANILA	$45.50	$46.00	36.40	38.25
HONG KONG	45.50	45.25	39.40	39.60
BOMBAY	47.15	47.00	48.75	47.50
TANGIER	46.00	46.50	37.00	36.90
BEYROUTH	45.00	44.75	37.10	37.10
PARIS	50.25	50.60	38.00	38.20
BUENOS AIRES	46.00	45.75	41.50	39.75

Note: All prices are computed at the free or black market value of the U. S. dollar in the local markets.

Major Metals

U. S. DAILY AND AVERAGE PRICES

May 1953	Electrolytic Copper (a) Domestic	(b) Export	Straits Tin New York	Lead New York	Lead St. Louis	Zinc East St. Louis
1	29.675	29.825	93.000	12.500	12.300	11.000
2	No Market	29.925	93.000	12.500	12.300	11.000
4	29.650	29.925	96.500	12.500	12.300	11.000
5	29.675	29.925	98.000	12.500	12.300	11.000
6	29.675	29.925	100.000	12.500	12.300	11.000
7	29.675	29.800	100.750	12.500	12.300	11.000
8	29.625	29.725	98.500	12.500	12.300	11.000
9	No Market	29.525	98.500	12.500	12.300	11.000
11	29.650	29.625	96.500	12.500	12.300	11.000
12	29.700	29.625	96.375	12.500	12.300	11.000
13	29.700	29.550	97.000	12.500	12.300	11.000
14	29.700	29.625	98.000	12.500	12.300	11.000
15	29.700	29.850	98.500	12.500	12.300	11.000
16	No Market	29.725	98.500	12.500	12.300	11.000
18	29.700	29.625	99.500	12.750	12.550	11.000
19	29.700	29.600	100.000	13.000	12.800	11.000
20	29.700	29.600	99.000	13.000	12.800	11.000
21	29.700	29.550	97.500	13.000	12.800	11.000
22	29.700	29.600	95.750	13.000	12.800	11.000
23	No Market	29.700	95.750	13.000	12.800	11.000
25	29.700	29.700	97.250	13.000	12.800	11.000
26	29.650	29.700	96.000	13.250	13.050	11.000
27	29.675	29.725	97.000	13.250	13.050	11.000
28	29.700	29.625	96.000	13.250	13.050	11.000
29	29.700	29.700	95.500	13.250	13.050	11.000
30	No Market	29.750	Holiday	Holiday	Holiday	Holiday
AVERAGES FOR MONTH						
May	29.683	29.710	97.295	12.750	12.550	11.000
AVERAGES FOR WEEK						
May						
6	29.640	29.854	95.750	12.500	12.300	11.000
13	29.670	29.642	97.938	12.500	12.300	11.000
20	29.700	29.671	98.917	12.708	12.508	11.000
27	29.685	29.663	96.542	13.083	12.883	11.000
CALENDAR WEEK AVERAGES						
May						
2	29.650	30.008	94.250	12.333	12.133	11.000
9	29.660	29.804	98.708	12.500	12.300	11.000
16	29.690	29.667	97.479	12.500	12.300	11.000
23	29.700	29.613	97.917	12.958	12.758	11.000
30	29.685	29.700	96.350	13.200	13.000	11.000

Silver, Gold and Sterling

DAILY AND AVERAGE PRICES

May 1953	Sterling Exchange "Checks"	Silver (c) New York	Silver London	Gold London	Gold (d) United States
1	281.8125	85.250	74.000 d.	248s.	$35.00
2	(e)	(e)	(e)	(e)	35.00
4	281.8750	85.250	74.000 d.	248s.	35.00
5	281.8125	85.250	74.000 d.	248s.	35.00
6	281.7500	85.250	74.000 d.	248s.	35.00
7	281.6875	85.250	74.000 d.	248s.	35.00
8	281.1250	85.250	74.000 d.	248s.	35.00
9	(e)	(e)	(e)	(e)	35.00
11	281.4375	85.250	74.000 d.	248s.	35.00
12	281.2500	85.250	74.000 d.	248s.	35.00
13	281.1250	85.250	74.000 d.	248s.	35.00
14	281.4375	85.250	74.000 d.	248s.	35.00
15	281.4375	85.250	74.000 d.	248s.	35.00
16	(e)	(e)	(e)	(e)	35.00
18	281.5625	85.250	74.000 d.	248s.	35.00
19	281.5000	85.250	74.000 d.	248s.	35.00
20	281.4375	85.250	74.000 d.	248s.	35.00
21	281.5000	85.250	74.000 d.	248s.	35.00
22	281.3750	85.250	74.000 d.	248s.	35.00
23	(e)	(e)	(e)	(e)	35.00
25	281.3750	85.250	Holiday	Holiday	35.00
26	281.3750	85.250	74.000 d.	248s.	35.00
27	281.3125	85.250	74.000 d.	248s.	35.00
28	281.2500	85.250	74.000 d.	248s.	35.00
29	281.3125	85.250	74.000 d.	248s.	35.00
30	(e)	(e)	(e)	(e)	Holiday
AVERAGES FOR MONTH					
May	281.464	85.250	74.000d.	—	35.00
AVERAGES FOR WEEK					
May					
6	281.825	85.250	—	—	—
13	281.325	85.250	—	—	—
20	281.475	85.250	—	—	—
27	281.388	85.250	—	—	—

Calendar Week Averages, New York Silver: May 2nd, 85.250; 9th, 85.250; 16th, 85.250; 23rd, 85.250; 30th, 85.250.

(e) No Market (Saturday).

THE above quotations for major non-ferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis. All prices, except gold and silver, are in cents per pound.

(a) Net prices at refineries on Atlantic seaboard. To arrive at the delivered New England basis add 0.300c. per pound, the average differential for delivery charges.

(b) Our export quotation for copper reflects prices obtaining in the open market and is based on sales in the foreign market reduced to the f.o.b. refinery equivalent, Atlantic seaboard. On f.a.s. transactions we deduct 0.075c. for lighterage, etc., to arrive at the f.o.b. refinery quotation.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingotbars; cathodes are sold at a discount of 0.125c. to 0.15c. per pound. Quotations for zinc are based on Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High Grade zinc delivered, in the East, Middle West, and West, effective Jan. 1, 1951, commanded a premium of 1.35c. per pound over the current market for Prime Western; Special High Grade 1.50c.

Quotations for lead are based on domestic common lead. Corroding lead commands a premium of 10 points.

(c) The daily New York silver quotation reported by Handy & Harman is for silver contained in ores and other unrefined silver-bearing materials, in cents and fractions of a cent per troy ounce. It is determined by Handy & Harman on the basis of actual sales of bar silver .999 fine in amounts of 50,000 ounces or more for nearby delivery at New York, as reported daily by regular suppliers, and is usually one-quarter-cent below the price paid for such bar silver, this deduction being the allowance to such suppliers for carrying, delivering and marketing. In addition to foreign silver, the quotations also apply to domestic silver if such silver enters into the New York market.

The Treasury's purchase price of newly mined domestic silver is 90.5c. per troy ounce 1000 fine, effective July 1, 1946. London silver in pence per troy ounce, basis .999 fine.

(d) U.S. Treasury's gold price. Actual payment by the United States Treasury for gold is at 99.75 per cent of the price quoted by the Treasury, which is equal to $34.9125.

Behind the By-Lines . . .

G. P. Lutjen

If you've been in the mining game long enough to know what a "John B." is, we have a real treat on tap which will probably have you wading knee-deep in nostalgia. If you don't know what a "John B." is, by the time you have read "Boom at Rhyolite," pages 94-95, you'll sadly realize that you were born approximately 50 years too late.

In two pages of the most fascinating reading we have scanned in a long time, Atha Albert Richie, famous single-jack champion of the Nevada boom days, gives you his personal glimpses of a town that in 1905 was a roaring mining camp, and today is a ghost town. Flip over to page 94 and let Mr. Richie show you around the Rhyolite that was, and introduce to you such notables as "Bullfrog" Clark, "Happy Jack" and "Snowshoe Charlie."

While sulphur, according to the experts, is not exactly running out of our collective ears, it seems to be running out of our stacks and numerous other outlets around smelters, refineries and miscellaneous plants. Nice thing though, is that the problem of recovering this sulphur has such a profitable solution—as many people are finding out.

Among those having more than a passing interest in the sulphur situation is Seymour Schwartz, whose article on page 77 will bring readers up to date on the Mexican sulphur situation—and a surprising situation it is, too. Mr. Schwartz heads up S. Schwartz & Associates, a firm of consulting engineers specializing in sulphur. If you want anything, from the forecast of the sulphur supply and demand in lower Mesopotamia, to the design of a low cost recovery plant, they'll tackle it. Mr. Schwartz himself is a young man who has been in the sulphur business since his days as trouble shooter for the Southern Acid and Sulphur Co. back in 1942. After that he was Allied Chemical and Dye's man for sulphur. He was in on the ground floor of the design of the first two commercial sulphur recovery plants in the U. S. to use the Clause process. Another achievement: He played a big role in getting the world's second largest sulphur recovery plant (Mexico) on stream. We feel that Mr. Schwartz's enthusiasm for sulphur qualifies him to discuss Mexico's future role as an important sulphur producer.

"Plumbing in Sweden—p. 84" is a cryptic note we have been carrying around in our pocket on the back of an old wrinkled envelope since our chat about the June issue with the managing editor last week. At odd moments, between bites of peanut butter and jelly sandwiches, during TV commercials, while chalking our pool cue, we have thought intently about what a treatise on Scandinavian pipefitting could be doing in *E&MJ*. No telling how long this idle speculation would have gone on if we hadn't dug out the page proofs. Turns out to be an excellent engineering article on shaft plumbing at Malmberget, by mine surveyor Kauno Kangas. We recommend this paper for mining engineers everywhere, particularly those involved with shaft work.

We don't quite know what to make of this, so we'll just pass it along without comment. The Moscow government recently requested copies of a pamphlet written by one of General Electric Co.'s officials. Title of the brochure is "How to Deal with Communistic Unions."

On second thought, this is a logical move. Probably a fair majority, say 100%, of the unions in Russia are inclined to be leftist.

Everyone has read a "Whodunnit?" at one time or another. In this issue we present the technical version, or "Whatdunnit?". The plot deals with some startling improvements in grinding at a certain mill. A well-known group of Private Eyes is working on the case, and suspects include a Hardinge Tricone mill, a sulphide ore, and a Dorr Hydroscillator. Run your eye over the facts on page 86 and do your own sleuthing.

While rounding up opinion on this story, one Practitioner of the Ancient and Honorable Art of Ore Dressing advanced an intriguing idea. He feels that there is as much to learn about the science of grinding from a study of why grinding circuits failed, as there is from reading about how they succeeded. We like this idea, and publishing such case histories could be a solid contribution to our knowledge of milling. We feel however, that it is going to be difficult to get some millman to submit an article like "How We Fouled Up Grinding at the Idle Hour Mill."

Any volunteers?

Special Note To Cobalters. All you mining men who ever rode a cage in Cobalt's famous silver camp ought to start getting ready for a return visit to the camp. It celebrates its 50th Anniversary during the week of July 5th to 11th and present day Cobalters assure us that this will be a celebration that compares favorably any held during the boom days of Cobalt.

For those who only know of Cobalt as the camp that produced fabulous wealth in silver between 1903 and 1920 at probably the greatest rate of silver production in history, we hasten to state that the "old silver camp" is neither "old" nor is it entirely a "silver camp." Today's Cobalters are busy producing wealth from new mines as well as old ones. Within the past two years four mills have been built or reconditioned. While silver is still an important factor, the production of cobalt is gaining prominence and is, in fact, the basis for future expansion plans. It really sets a mining man's heart pumping on both ventricles to visit an old "worked out" camp and find the activity and enthusiasm of a brand new prospect.

We leave the last word this month to an old beachcomber friend of ours who once told us that there are more important things in this world than money, but they will not go out with you if you're broke.

ENGINEERING AND MINING JOURNAL

JUNE, 1953

Let's Learn From the Past

CONSUMPTION OF METALS, in the United States at least, sails right along at amazingly high levels. Even the collapsed European markets look stronger as this is being written.

Yet there has seldom been a time when as many people in the mining industry throughout the world have been as worried over their immediate problems as they are today.

Domestic lead-zinc miners are worried over low metal prices and shut-down mines. Foreign lead-zinc miners are worried over a possible increase in U. S. tariffs.

Domestic copper miners are wondering, if not worrying, about what the high rate of imports will do to the U. S. copper market. Foreign copper miners are wondering what the London Metal Exchange will do to the world's copper markets next August. And in Chile, everyone is worried over the inevitable drop in the country's income when it becomes no longer possible to sell Chilean copper for 35½c. per lb.

In Bolivia everyone is worried over the problem of selling tin for a price higher than anyone now wants to pay.

In all of these areas, the interested parties are hotly engaged in seeking the cause of their difficulties in order to eliminate it, or protect themselves against it. We, too, have sought by study and by interview to find some quick or easy way to solve one or more of the foregoing problems.

We have about concluded that the culprit is the same in each case and is equally beyond our immediate reach in all of them. It is all too easy to blame the Democrats, or the other fellow's government, the producer of foreign, or domestic, metal. None of them is, however, more than an individual force acting in response to circumstances, most of which he did not select and over which he has little or no control.

The nations of the world are still paying the cost of fighting World War II and preparing to fight World War III, if necessary. The dislocations this effort stirs up are simply incalculable, even though most of our problems can be traced directly to them.

The enormous economic inflation that came as an aftermath of the war is still a threat in this country. Elsewhere in the world some effort at deflation is making headway. The Eisenhower administration is trying valiantly to establish "sound money" and a balanced budget, but is finding it heavy going.

No real solution to the world's problems of trade, such as those outlined in the opening paragraphs, is possible until there are (1) freer exchange of currencies, (2) fewer restrictions on trade, and (3) fewer political and ideological barriers between nations.

It could be that we are entering an era of comparative peace. If so, there is some hope that current policies adopted by a few countries could lead to a healthier economic climate generally. But it is unlikely that severe measures, taken to cure some immediate pressing problem, will do other than leave even more severe problems in their places.

Over the past few years we have frequently observed that most people tend to regard the immediate problem as if it were a permanent situation. They therefore take whatever action they believe will cure that situation, even though it may not be the best move to make in the light of the future.

We cannot resist pointing out that the U. S. government did exactly that in encouraging people to shift from copper to aluminum, to engage in vast projects to produce more zinc, for example, and in encouraging the Chilean government to establish a higher price for her copper simply because the terrific demand enabled her to get it easily.

Certainly the government was not, and is not, alone in pursuing the fallacy of treating each succeeding problem as if it were a permanent condition. Many industry members are driven from one extreme to the other by the force of events, despite the clear evidence of history that a balance tends to be restored.

We mention all this in the feeling that a recognition of the real source of our troubles, that is the imbalances left in the wake of war, can aid in determining courses of action that can help to resolve these imbalances, not further disturb them.

Only thus can a real solution be found to those problems of imports and exports, of currency exchange, and to those special problems of raw material producing nations like Chile and Bolivia, the repercussions of which can be so profoundly disturbing to us all.

SIDE-DUMP TRAILER, loading ore, takes a 30-35-ton pay load. This type works well in all operations with all materials. It is much used in winter work, having no difficulty with large fragments or frozen chunks. Box can be completely filled, with less spillage than with end-dump type, as all four sides are enclosed. The same truck is seen stocking ore in pit in cut below, in dumping at pit picket on page 74, and elsewhere. It has four-wheel-drive tractor with 275-hp. butane-burning motor. Tires are 14:00 x 24.

Semi-Trailer Truck Has Place

DISCHARGING LOAD OVER DUMP in course of stocking ore in pit in winter operation. These three side-dump trailers are doing work for which they are well adapted. Oversize material gives no difficulty and they can dump

THIS BOTTOM-DUMP SEMI-TRAILER, hauled by four-wheel-drive tractor with 275-hp. butane-burning motor, takes 35-40-ton pay load. It is best suited for ore haul to pocket on regular cycle, coming up ramp, dumping by simple mechanism in less than 5 seconds, and continuing without backing or delay. In stripping, bottom opening is too restricted for larger boulders and frost chunks. Box shown is too hard to clean in freezing weather. Long, deep box loads well, with less spillage than side- or end-dump boxes. Tires throughout at 14:00 x 24.

in Modern Open-Pit Haulage

while moving. They can discharge over edge without danger of going over.

JOHN F. LINDEN
Superintendent, Longyear Mine
Jones & Laughlin Steel Corp.
Hibbing, Minn.

IN THE LATE 1930's, the Jones & Laughlin Steel Corp.'s Minnesota Ore Division, then known as the Inter-State Iron Co., had been mining open-pit iron ore on the Mesabi Range since the turn of the century. The equipment it used for haulage and transport was standard for the period. By 1935 it consisted of the latest type of railroad cars hauled by modern steam and electric locomotives.

Shortly before 1940, however, the problem of maintaining production schedules at reasonable cost made it imperative to consider new heavy-haulage methods seriously. The mines were becoming deeper, railroad grades and switchbacks were increasing, and large tonnages of ores were of necessity tied up in the growing number of track benches.

A new mode of haulage was sought which would operate on relatively steep grades as compared to locomotives, permit maximum recovery of ore, be competitive in cost, and allow selective mining combined with quantity production. After exhaustive study a decision to employ truck haulage was made.

Having decided on truck haulage, the management reviewed the machines available for the job. Heavy-duty truck haulage had already gained prominence on the Minnesota iron ranges. One iron ore producer on the Western Mesabi had pioneered in open-pit heavy-duty truck haulage, and in the late 1930's was conducting mining and stripping operations

DUMPING ORE AT POCKET in pit, with second side-dump trailer coming up ramp to right of pocket. Arrangement of ramp is illustrated—truck ascends to pocket and dumps, taking about 40 seconds without backing up or other delay, then continues on and down return road. Semi-trailer is at its best at this type of planned operation where complete cycle is established. Side-dump type is shown in other pictures also.

on a large scale. Other operators had followed a similar course. The haulage units were of all sizes, though smaller than today's models, and were doing excellent work. Trailer units were relatively untried on the Mesabi, though used extensively in other fields.

The semi-trailer truck, it was finally decided, was better suited to the needs of the several mines involved, primarily because of its large capacity. Here was a truck capable of hauling 30 tons or more, as compared with 15 tons for the largest end-dump models. Such pay loads were highly desirable, as can be readily seen. They are now commonplace in the industry.

Semi-Trailers at Four Mines

The first semi-trailer trucks arrived at J. & L.'s Grant mine near Buhl, on the Mesabi, during the winter of 1940-1941. Identical equipment with certain modifications was later used at the Columbia, Hill Annex, and Longyear mines. By the fall of 1943 the company had four mines using semi-trailer truck haulage.

The haulage assembly, as purchased, included a four-wheel-drive tractor-truck drawing a side- or bottom-dump trailer attached to the tractor by a fifth-wheel arrangement. The trailer rolled on a single axle with dual tires supporting the rear end of the unit. The entire assembly, tractor and trailer, was mounted on 14:00 x 24 tires. The side-dumps units were rated at 16 cu. yd., and the bottom-dump trucks around 17 cu. yd.

The Longyear mine experimented and made extensive use of rear-drive tractor units. Results

HAULING ORE AFTER HEAVY RAIN, this bottom-dump trailer functions well, carrying full 35-40-ton pay load, and is equal to any truck under like conditions. Prolonged exposure to deep water will cause brake trouble on most trucks, inasmuch as water and muck get inside the drums.

ANY CHUNK that can be loaded can be dumped easily by side-dump trailer. This is one of the good features of this type of haulage unit. In ore operations in the summertime, size of material that can be handled is limited by what can be accommodated at pocket.

were very good, but it was evident that the four-wheel-drive tractor has the advantage in semi-trailer haulage. Experience proved this drive superior for pulling heavy loads on the steep grades found in the iron mines. The additional front-end traction has been of great value on slippery and icy roads. These units have operated under every adverse condition over a period of years, and at no time were operations suspended due to road conditions.

Several years ago, personnel at the company's Columbia mine at Virginia, on the Mesabi, made a very important improvement on the side-dump trailers in use on that property. The rear axle was modified to some extent, and the 14:00 x 24 trailer dual tires were discarded in favor of single 21:00 x 25 tires. This change resulted in lower tire costs and easier haulage, as the larger tires introduced a certain amount of flotation enabling the trailer to ride over soft ground; while the smaller tires were prone to plow and push the soft material ahead of the trailer wheels.

Favorable and Not So Favorable

The desirable features of the semi-trailer trucks may be summarized as follows:

1. Together with large capacity they have shown low road-maintenance costs.
2. The ratio of pay load to dead weight is favorable.
3. They dump speedily and well.
4. The low center of gravity of the bottom-dump trailer enables it to haul with a minimum of sidesway.
5. In all cases, trailer tire costs were low, and where four-wheel drive tractors were used, the tire costs were low throughout. In the instance where rear-drive tractors were employed the drive tires exhibited greater wear as would be expected. Examination of the tire tracks in the latter case revealed a certain slippage, resulting in higher than normal tire costs.

The semi-trailer also exhibited characteristics that tend to limit their use:

1. The trailer truck is not as mobile as the end-dump truck since it has greater turning radius and is at a disadvantage on soft ground.
2. The bottom-dump trailer is not the best in stripping operations, as the discharge opening is too restricted to handle large boulders and slabs of frozen materials. Also, in this operation the trailer wheels are pulled over the discharged load, tending to damage tires when dumping sharp materials. Bottom-dump type works best on ore operations in summer.
3. Pit grades are kept around a 7 or 8% maximum, with easy curves and hard, well-constructed roads. Although trailers will operate on grades in excess of 10%, it is not to their advantage.

Versus the End-Dump

At present writing it would appear that the end-dump truck is enjoying the popular favor on the Mesabi Range. This is due to no inherent fault of the semi-trailer. In 1940 the semi-trailer payload was roughly twice that of the largest standard end-dump truck. Large capacity, however, is no longer an exclusive feature of any truck. Further, mechanical and technological advances in truck design have not been incorporated in four-wheel-drive tractors in the past, and this fact hindered the de-

CLEANING SIDE-DUMP BOX of sticky or frozen material is done in this manner. Bottom is smooth and flat and can be cleaned better than in end-dump or bottom-dump trucks. Bottom-dump is hard to clean at any time, as cleaner has to climb on or into box. To date, heating has not been used on trailer boxes as it has on end-dump units.

BACKING SEMI-TRAILER into tight places as here has been mastered by experienced drivers. Here an ore cut is being started under difficult circumstances.

A NEW IDEA as to rear tires of semi-trailers has been developed by local management of one of J. & L.'s mines. After modifying rear axle, single large tires, 21:00 x 25 in. size, here seen, were substituted for smaller dual 14:00 x 24 tires. This resulted in lower tire costs and easier haulage.

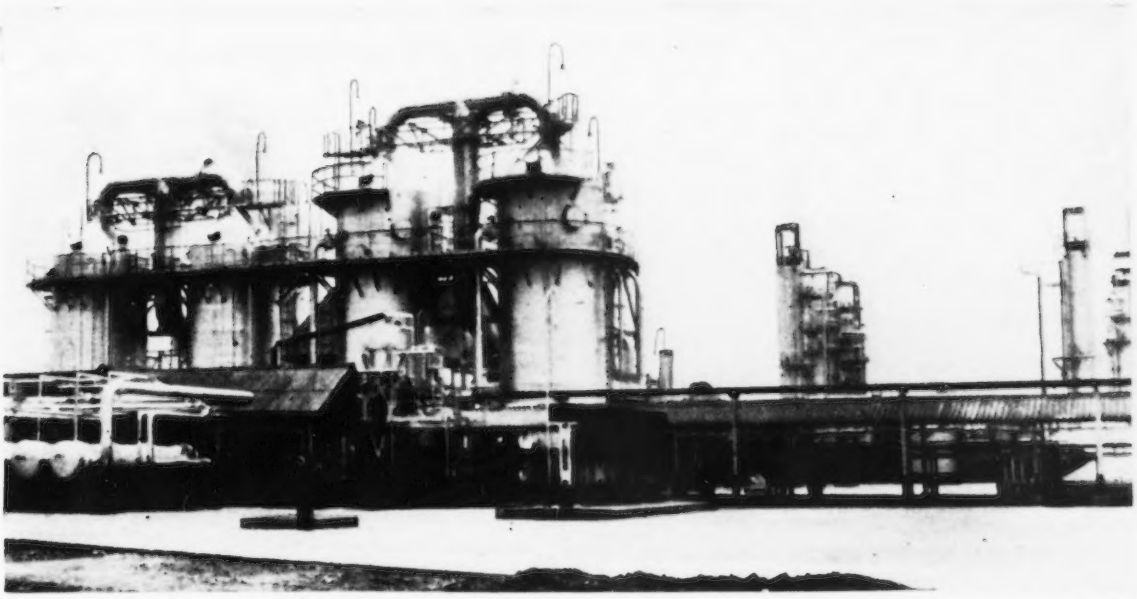
velopment of trailer haulage. Recently, however, a very good four-wheel drive tractor has been introduced, and is doing excellent work at the Columbia and Longyear mines. This truck is modern, and will do much to stimulate interest in trailer haulage.

Highly Satisfactory

The results of semi-trailer truck haulage at the several mines of J. & L.'s Minnesota Ore Division have been highly satisfactory. Large tonnages of ore and waste have been handled. In 1945, the Hill Annex mine alone moved close to 3-million tons of crude ore during the summer ore season. The material was gathered from a 200-acre pit and delivered to a belt conveyor. Working around the clock with seven side-dump trailers on the run, this fleet hauled a maximum of 24,000 tons of ore in 24 hours. The large capacity trucks were ideal for this job. The feature of large pay load was important, and until recent years distinctive. The trailers did outstanding work and exceeded expectations.

An Opportunity

As mine operators are ever on the alert for better and more economical ways of transporting bulk materials, the future of the semi-trailer will depend upon the initiative and foresight of manufacturers in their quest to capture markets. The field is wide open—the opportunity is present.



SULPHUR PLANT of Petroleos Mexicanos, second largest in world, was started in 1951. Condensers are shown.

Mexico Challenges Sulphur Shortage

Potentially, the Country Is the World's Second Largest Producer

SEYMOUR SCHWARTZ
S. Schwartz & Associates
New York

THE WORLD-WIDE sulphur shortage has brought a potentially large producer of sulphur into the world picture, namely the Republic of Mexico. Prior to the current situation, Mexico, dependent on the United States for its supply, produced small amounts of sulphur from her mines and imported the bulk of her requirements from the Gulf Coast. During the period 1945-1948 production shuffled along at a rate of 2,100 to 7,100 tons per year, most of it coming from small operations in Lower California and San Luis Potosi. With the industrialization of the country's economy and the expansion of fertilizer and chemical production facilities, the demand for sulphur required that important steps be taken. At the same time the world shortage was developing.

Table 1. Sulphur Production in Mexico

Year	Gross Tons
1945	7,100[2]
1946	
1947	3,200[2]
1948	2,100[2]
1949	5,400[3]
1950	11,200[3]
1951	30,835[1]
1952	46,000 (est.)

[1] See end of article for references

Mexican production of sulphur in 1948 was small compared with the country's requirements. In 1949 the output quadrupled that of the previous year. During 1950 the increased demand led to almost a doubling of the quantity imported. This shortage in turn gave way to a sharp increase in the price offered by Mexican consumers. In the first quarter of 1951 the price in Mexico tripled.[1]

The solution to the shortage problem in Mexico was not without planning. In the fall of 1948 Petroleos Mexicanos, to aid in meeting the demand for fuel and fertilizer in Mexico City, took steps to erect a gas-treating plant in the sour gas field at Poza Rica. The object was, first, to obtain a usable raw material which could be piped to Guanos y Fertilizante on the city's outskirts for producing ammonia and, second, to recover the waste hydrogen sulphide and convert it to elemental sulphur. Both objectives were attained.

In the fall of 1950, the gas treater went on stream which produced sweetened natural gas. On Easter Sunday in 1951 the world's second largest sulphur recovery plant, that of Petroleos Mexicanos, went into operation. Previously, the bulk of Mexico's sulphur requirements had been met by Negocia-

[1] See "References" at the end of the text.

cion Minera de Azufre, a small producer, and by imports from the United States. The establishing of this sulphur recovery plant brought about Mexico's conversion from a net importer to an exporter in the world market.

The importance of this plant, which had required the solving of a number of difficult problems, deserves added comment. Operating at a recovery rate of 120 tons per day from a very weak gas, the plant tripled Mexico's sulphur output and made it possible to multiply exports ten times. For the first time Mexico had available a substantial source of sulphur independent of the American market.

The output of this plant is reflected in Table 1, which shows the trend of production of sulphur in Mexico.

Recognition of Mexico's new position in the world sulphur picture was made recently by the International Materials Conference. In 1951 it reallocated 5,000 tons of this commodity set aside for Mexican needs and in 1952 it granted an export allocation of 12,000 tons.

Many new developments in various stages of planning or execution portend a bright future for Mexico's budding brimstone industry. The following may be mentioned:

Table 2. Production of Crude and Recovered Sulphur

Gross Tons

Country	1947	1948	1949	1950	1951
United States	4,441,214	4,869,210	4,745,014	5,192,184	5,462,262
Italy	146,310	170,904	185,567	209,767	216,000
Norway		79,000[3]	81,000[3]	96,000[3]	100,000*
Japan	28,670	40,120	61,414	90,940	139,364
Mexico	3,200[2]	2,100[2]	5,400[3]	11,200[5]	30,835[1]
Argentina	13,000		9,842	10,000	10,000*
Chile	11,717	13,258	6,924	15,400[3]	30,000*

* Estimated. [1] For all references see end of article.

Table 3. Estimated Annual Sulphur Production in Mexico

Gross Tons

Producer	1952	1953	1954	1955
Petroleos Mexicanos	36,000	42,000	60,000	65,000
Neg. Min. Azufre, S.A.	10,000	18,000	20,000	20,000
American Sulphur & Refining Co.		2,000	24,000	33,000
Mexican Gulf Sulphur Co.		30,000	90,000	200,000
Pan American Sulphur Co.				45,000
Socorro Island			2,000	10,000
Miscellaneous surface producers	2,000	2,000	5,000	10,000
Totals	48,000	94,000	201,000	383,000

New Sulphur Projects

In Frasch-Process Sulphur. Mexican Gulf Sulphur Co., operating through a Mexican subsidiary, has received a loan of $1,875,000 from the Export-Import Bank. As a result it is completing the construction of a Frasch mining plant on the San Cristobal salt dome near Minatitlan, Vera Cruz. This plant may be expected to start production in the second quarter of 1953 and, when operated at capacity, is expected to produce 200,000 tons of sulphur per year.

A second potential producer, Pan American Sulphur Co., which operates through its subsidiary, Gulf Sulphur Company de Mexico, S.A., has done considerable exploratory drilling on its concessions at Jaltipan, Vera Cruz. It is planning to erect a $5-million plant for producing a minimum of 300,000 tons of sulphur per year. Construction is expected to be complete in August, 1954. The plant will be financed in part by a loan of $3,664,000 by the Export-Import Bank.

A third venture for the more distant future is that of Gulf Sulphur Corp. Its operating subsidiary, American Sulphur Co., S.A., commenced exploitation of sulphur in Mexico in December, 1951. Currently, it is drilling the so-called Mezquital concessions on the Isthmus of Tehuantepec. Most recent reports on its fourth well indicate a rich sulphur formation at the 450-ft. depth.

The world's largest sulphur producer, Texas Gulf Sulphur Co., has been exploring its concessions on the Isthmus of Tehuantepec for a number of years through its subsidiary, Cia. Exploradora del Istmo, S.A.

Recovery from Natural Gas. Petroleos Mexicanos' sulphur recovery plant, which operates at the capacity of the Girdler unit to deliver hydrogen sulphide gas, is believed capable of producing 25-50% additional sulphur without any changes in the existing plant.

When expansion of the Girdler unit is completed, believed to be sometime in 1953-54, it is estimated that the sulphur plant will be capable of producing 185-240 tons of sulphur per day.

Recovery of Volcanic Sulphur. Neg. Min. de Azufre, S.A., Mexico's principal mined-sulphur operator, currently produces no more than about 30 tons per day. However, this company is understood to be planning the installation of additional equipment which will double its current rate.

An American producer, new to Mexico, is said to be entering the surface-sulphur picture in a substantial way. Affiliated with Azufre Refinados de Mexico, S.A., through financial arrangements, the American Sulphur and Refining Co. is currently engineering a 100-ton per-day plant to be located in Baja California, adjacent to Mexico's large surface deposits. Construction is expected to start in 1953.

The possibility that another producer of volcanic-type sulphur may enter the picture was announced only recently when the Mexican Government granted a sulphur concession on the uninhabited Socorro Island, 369 mi. off the coast of northwest Mexico.[4] This deposit, said to contain 800,000 tons of sulphur of 95% purity, is expected to produce 200 tons of sulphur per day in about a year, according to concession holders.

Expected to Grow

Mexico's Position in the World Market. As a consequence of Mexican expansion in the sulphur industry one may ask, "Where does all of this actual and planned production place Mexico in the world market? How does she compare with present-day producers?"

Production statistics for the large sulphur-producing countries, based on information available from the U. S. Bureau of Mines

and other sources, are shown in Table 2.

The data in this table show that, on the basis of past performance, Mexico has been an inconsequential element in the world sulphur pattern. The same has been true for the other South American countries who met their requirements by importing cheap American sulphur. When the world sulphur shortage finally did develop and brought with it fantastically high free-market prices, only then did domestic production increase.

Japan, under the stimulus of a postwar economy, managed to attain substantial increases in production, notably a five-fold increase over a four-year period. The Italian sulphur producers, plagued by high labor costs, have been able to raise their output only about one and one-half times during the same period. Mexican output, on the other hand, increased almost tenfold.

An Appraisal

The Future for Mexico. To appraise Mexico's position in the world market properly it is necessary, first, to summarize planned and potential output and, second, to examine the industrial elements.

The production figures of several of the newly planned developments in Frasch, gas recovery and surface deposit sulphur, as reported by various sources, have been modified to extrapolate annual potential output properly. This is based on past performance and operating experiences. For example, in Frasch sulphur mining it is characteristic that no producer entering upon a dome for the first time is able to bring his production up to plant design capacity within a year from the start of production. The inherent characteristics of new salt domes is such that each is unique and each has to be "babied" before it will yield its sulphur in quantity.

Similarly, in estimating production of new companies on new locations, allowance must be made for the "gestation" period, from the time that initial exploration is begun until plant construction is completed. For surface sulphur or gas recovery plants, evaluation of various technical factors requires consideration. These are more amenable to judicious estimation.

After carefully considering the factors underlying each of the proposed producers in Mexico, an estimate has been prepared covering potential output. This is shown in Table 3.

Expansion of sulphur production in Italy has been slow and costly due primarily to the fact that approximately 80% of the production cost is labor. Efficiency of recovery from Italian deposits has been low, due to lack of fuel, mechanization, capital, and engineering know-how in the handling of such deposits. Only in times of severe shortages or when sulphur prices range from $65 to $130 per ton, do Italian sulphur operations become economic.

Japan, on the other hand, is much in the same boat except that labor costs are lower relative to those of the Italian producers. Consequently, Japanese producers are able to respond to rising prices much more quickly, and can therefore share in a greater proportion of the world market. Utilization of new techniques in sulphur handling and recovery would be of greater relative benefit to them as well as those in Sicily.

Current production in Mexico, on the other hand, is based on recovery from a waste product, hydrogen sulphide, and an automatically controlled plant. The bulk of Mexico's future production, however, is expected to come from salt domes by the Frasch process. This process is characteristically a low-cost, large-tonnage operation in which labor approximates 35% of the cost of production. Moreover, fuel, which accounts for another 35% is generally found in the immediate vicinity of the salt domes, usually as highly desirable natural gas or oil.

Effect of Sulphur Price. At the present time a dual price exists for sulphur in the world market. One, a decontrolled price of about $30 per ton applies to the supply controlled by U. S. Government export licenses. A second, which currently ranges from $65 to $80 per ton, is in the "free" world market. This "free" market price reportedly has been as high as $180 per ton. With such high prices for sulphur it is no wonder that production from every nook and cranny of the world has been explored and expanded.

Should government export controls be dropped, there is but little doubt that several changes would occur. One would be a further increase in the current price and supply of American sulphur in export. Another would be a severe drop-off in the "free" world market price. The net effect would be a sharp curtailment of sulphur production in various countries which produce from surface or volcanic deposits since these are characteristically high-cost operators. In fact, it is understood that several Chilean and Japanese producers have already shut down their plants due to the current free-world market of about $65 per ton. In this same connection, surface sulphur producers in the United States, which were granted ceiling prices ranging from $80 to $125 per ton for sulphur in export, are also shut down.

Mexico, on the other hand, with a sulphur industry based on cheap Frasch sulphur and sulphur from waste hydrogen sulphide, is in an excellent competitive position. Mexican producers, therefore, should continue to share in the world market along with the American operators. By way of comparison, it is estimated that one of the newer Mexican sulphur producers may be able to compete in the world market with sulphur at $30 per ton and operation at 25% capacity although profit would be negligible. Capacity operation would result in a profit.

Marginal producers who have attempted to operate in the United States, those currently operating in Japan, Peru, Argentina and Chile have been plagued for a number of years with production and operating difficulties. This has been due primarily to a lack of engineering know-how for the "simple" element, sulphur—a lack of knowledge as to proper handling and treatment. The outlook for these producers is promising, nevertheless, as newer techniques are learned and more information on the element is disseminated.

Mexico, on the other hand, with a planned economy based on Frasch process mining, is far and above these marginal producers and will, no doubt, continue to expand and yield a low cost product. In expectation that world sulphur production and consumption will continue at a high level and a good price, Mexico bids fair to become an important producer.

References

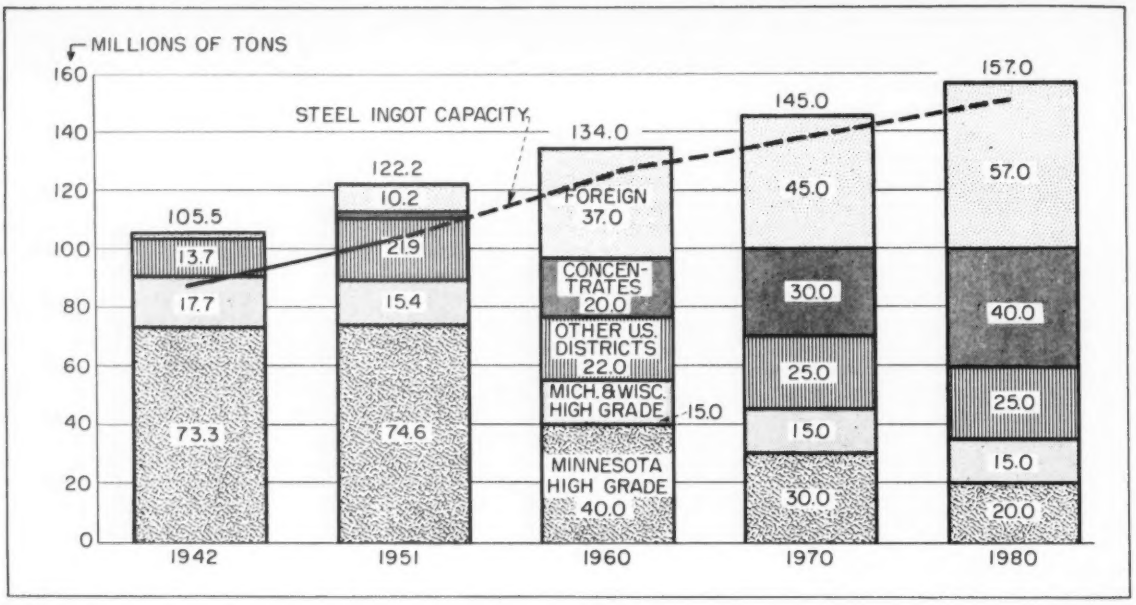
[1] Banco Nacional de Mexico, S.A., Bulletin No. 321, August, 1952.

[2] U. S. Bureau of Mines Minerals Yearbook, 1950.

[3] Report on Operations, International Materials Conference, 1951-1952. Washington, D. C.

[4] *Wall St. Journal*, Sept. 2, 1952.

[5] Nacional Financiera, S.A., El Mercado de Valores, Alfonso Cortina, No. 35, Sept. 1, 1952.



POTENTIAL SOURCES of iron ore supply for domestic furnaces in 1960, 1970 and 1980 are shown graphically in this chart, using the estimated data given in the accompanying table. Actual figures are used for 1942 and 1951.

Iron Ore Supply: A New

H. S. HARRISON
Vice President and Treasurer
Cleveland-Cliffs Iron Co.
Cleveland, Ohio

Mr. Harrison, a native of Cleveland, has risen rapidly since he graduated from Yale in 1932, after having prepared at the University School in Cleveland. After five years with Corrigan, McKinney Steel Co., Central Hanover Bank & Trust Co., New York, and Lionel D. Edie Co., he joined the Cleveland-Cliffs company, becoming treasurer in 1945 and vice president last year. He is a director of Jones & Laughlin Steel Corp. and a member of the American Economic Association and Cleveland Chamber of Commerce. In addition, many civic activities in Cleveland engage his attention.

"IN THE NEXT 25 YEARS," says the Paley Report, "the steel industry of the United States will consume 4-billion tons of iron ore to produce steel ingots worth $200-billion." While this prediction may be somewhat on the optimistic side, it does highlight the problem of the iron ore industry in the years to come.

A talk given before National Federation of Financial Analysis Societies April 13, 1953.

To get a perspective, we must remember that since ore was first discovered in the Lake Superior District in 1845, the nation's steel industry has consumed about 2.7-billion tons from this area. As this area has furnished about 85% of the ore consumed in this country, total domestic consumption has been about 3.2-billion tons. In other words, according to the Paley Report, we will consume in the next 25 years about one and one-quarter times as much ore as we have used in the last 100 years. The figure of 4-billion tons means an average consumption during this period of 160-million tons per year.

Big Task Ahead— Ore To Cost More

Although the Paley figures may be somewhat optimistic on this point, they do emphasize the fact that the iron ore industry faces a tremendous task in supplying the ore required. This task is further complicated by the fact that approximately 80% of the blast furnace capacity of the country's steel industry lies within the area from Buffalo and Pittsburgh on the east, through Ohio and Indiana to Chicago on the west. This Great Lakes area has been a natural meeting ground for Lake Superior ores on the one hand and Pennsylvania, West Virginia, and Kentucky coals on the other. For the past 60 years the open-pit, direct-shipping ore of the Mesabi Range has been the backbone of the iron ore supply for the country's steel mills. It is a safe prediction that never again will our steel industry here have such a

Potential Sources of Iron Ore Supply for Domestic Furnaces, 1960-1970-1980

	THOUSANDS OF TONS				
	1942	1951	1960	1970	1980
Steel ingot capacity—net tons, estimated for 1960, 1970, 1980	88,887	104,230	125,000	137,500	150,000
Iron Ore shipments—gross tons:					
Lake Superior District—					
Minnesota high-grade	75,300	78,931	40,000	30,000	20,000
Michigan and Wisconsin	17,709	15,419	15,000	15,000	15,000
Total Lake Superior	93,009	94,350	55,000	45,000	35,000
Other U. S. Districts	13,700	21,840	22,000	25,000	25,000
Total U. S.	106,709	116,190	77,000	70,000	60,000
Foreign	750	10,145	37,000	45,000	57,000
Concentrates	...	138	20,000	30,000	40,000
Total	107,459	126,473	134,000	145,000	157,000
Exports	2,000	4,296	...	...	...
Net shipments for U. S. consumption	105,459	122,177	134,000	145,000	157,000
Net Minnesota high-grade after shipments for export	73,300	74,635	40,000	30,000	20,000

Appraisal of the Outlook

cheap source of iron ore as this.

The heart of the problem is twofold, a dwindling supply of high-grade domestic iron ore on the one hand and an increase in the demand for ore on the other. It has always been known that eventually the ore supply of the great Mesabi Range would be exhausted. During the past eight years there has been throughout the iron ore and steel industries a concerted movement to obtain reserves for future protection. At the end of World War II several companies were already doing exploratory work in all parts of the world, and during the past few years there has been a veritable rush to secure reserves so that the steel mills would be adequately protected on this primary raw material.

The Available Reserves

Iron bearing material exists in abundance throughout the world. It is a matter of economics and national security rather than availability that governs. For present purposes there is little point in talking about definitive reserves in India, Southern Rhodesia, or China. We will consider only the reserves now most readily available, namely, those of the United States, Canada (including Labrador), South America, particularly Venezuela, and Sweden.

The United Nations has made a study which shows 53-billion tons of probable world iron ore reserves, not including low-grade reserves (where I speak of "tons," I mean long tons with reference to iron ore and net tons with reference to steel). The Paley Report estimates world reserves of iron ore (50% iron or over) at 54-billion tons. In any case, the tonnage is so enormous it is not a factor at all in the problem confronting us here.

Reserves of high-grade ore in the United States, however, are definitely another matter. These have been estimated variously from 3-billion to 6.5-billion tons, but a large part of this ore is not accessible to our present steel capacity except at prohibitive transportation costs. For example, ore in the Birmingham district is of no economic value to plants in Chicago. It is well to repeat here that approximately 80% of the blast furnace capacity of this country lies in the Great Lakes area which has depended in the past primarily on Lake Superior ores. The increased demand for the ores in this district constitutes the pincipal raw material problem confronting the steel industry today.

Various estimates have been made of the tonnage remaining in the Lake Superior district. Dr. John W. Gruner, of the University of Minnesota, estimated in the spring of 1950 that there was approximately 1.7-billion tons of iron ore in the Lake Superior District, of which about 750-million tons was open-pit, direct-shipping ores. This is probably conservative due to the fact that in the last ten years great technological advances have been made in open-pit mining and more particularly in ore beneficiation which have rendered commercially usable lean material formerly regarded as untreatable.

Reserves of High-Grade Lake Ores Insufficient

Our estimate of the tonnage of Lake Superior ore is 2.2-billion tons, exclusive of low-grade ores. This can be broken down as follows:

Minnesota	1,700,000,000 tons
Michigan and Wisconsin	500,000,000 tons

Michigan and Wisconsin high-grade reserves are practically all

underground ores. In Minnesota approximately 700-million tons would be open-pit, direct-shipping ores, 350-million tons underground ores, and 650-million tons beneficiated ores. It is obvious from these figures that the Lake Superior region has passed its prime as far as high-grade ore is concerned and that after 1970 the larger share of ore consumed by the country will have to come from low-grade ore concentrates and foreign ores.

A great deal has been said and written about low-grade ores of the Lake Superior ranges. Some estimates have placed these reserves as high as 60-billion tons of crude ore. At the present time there is no possibility of any such tonnage as this. Such figures have little meaning unless one foresees the development of revolutionary processes which would make it possible to mine the whole Mesabi Range taconite formation of a thickness of 500 to 750 ft. from top to bottom. Furthermore, it assumes some chemical process of separating the SiO_2 which cannot be removed by any known or conceivable mechanical method. A realistic and authoritative estimate has recently been published in the Federal Reserve Bank of Minneapolis "Monthly Review," February, 1953, issue, which showed the reserves of concentrates to be made from the low-grade ores of the Lake Superior District at 8.1-billion tons, of which 1.7-billion are magnetic.

Other Ores—U.S. and Foreign

As to other orebodies in this country, I cite the estimates of Dr. Carl Dutton of the U. S. Geological Survey, as follows:

Southeastern	1,250,000,000 tons
Northeastern	380,000,000 tons
Western	400,000,000 tons
Central	60,000,000 tons

Turning to the foreign picture, we estimate Canada's reserves (including Labrador) at 1.5-billion tons at least, with an iron content exceeding 50%. We estimate Venezuelan ore also at 1.5-billion tons at least, much of which is over 60% iron. Little is actually known about Brazil's tonnage, which may run 4-billion tons or more. Much of it, however, is not readily accessible at present. Reserves of other South American countries, including Chile and Peru, amount to several hundred million tons. Sweden has approximately 2-billion tons of high-grade ore, much of which will be required for use on the European Continent.

To summarize the reserve picture, the Lake Superior region's high-grade ores will not be able to supply the major portion of the requirements of the country's steel industry. Foreign ores and concentrates from domestic low-grade ore will take on more and more of the load, with Canada and Venezuela the principal sources of foreign ores, at least in the foreseeable future.

Ore Demand in 1980 157 Million Tons

The demand for iron ore, is of course, directly dependent on the demand for steel, which in turn is geared rather closely to general business activity of the country. Various projections of population increase and per-capita steel consumption show a minimum figure of 145-million tons of steel demand in 1980. To satisfy a demand in 1980 of 145-million tons, we estimate steel capacity of 150-million tons at that time. The Paley Report estimates the consumption of steel in 1975 at 150-million tons and, as a corollary, it projects iron ore consumption at 179-million tons. Our projection to meet steel consumption of 150-million tons in 1980 is 157-million tons of iron ore because, with the higher iron content of the taconite concentrates and foreign ores, the ore per ton of steel will be reduced.

This figure is probably too conservative. In talking to various people of the steel, iron ore, and scrap industries, I have been unable to find anyone who will agree to that low a ratio. The principal reasons are that the scrap situation is changing in two respects. In the first place, there is not as much heavy scrap generated today and, secondly, there is more alloy steel which is unsatisfactory for use as scrap. Furthermore, government economists believe that, after reaching 100-million tons of steel production, the ratio of iron ore per ton of steel would go up sharply because, while scrap is available for 100-million tons of production, it becomes less and less so as production increases. At any rate, at the level of 150-million tons of ingot production, it can be assumed that our figure of 157-million tons is going to be a minimum.

Before determining where this 157-million tons is going to come from, it is necessary to get a general idea of the various costs and risks involved for the various sources of iron ore, namely: (a) Mesabi open-pit; (b) foreign; (c) concentrates of low-grade ore; (d) Lake Superior underground.

The steel industry is, of course, going to obtain its ore from the source which is cheapest, but which at the same time offers some measure of security. Consequently, a delicate balance will have to be maintained between cheap ore with high risk and high-cost ore with no risk.

(a) Mesabi Open-Pit Ores. At the top of the ladder of preference are the open-pit ores of the Mesabi Range. These are the cheapest ores the steel industry will ever have, although even they are not as cheap as they used to be.

In the past, in most open-pit mining it was necessary only to remove on the average less than 1 ton of stripping per ton of ore developed in mining. Now it appears evident that open pits in the future will require up to ten tons of stripping and other material to be moved for each ton of ore shipped. New pits will be deeper and in many cases much smaller. Nevertheless this will still be the cheapest source of ore, although the amount will be definitely limited.

Thirty years from now, not much more than 10% of the ore consumed by our steel industry will be high-grade ore from open-pit mines. The great Mesabi Range will still be great, both because of its past and because of its future in taconites, but gone forever are the days when the Mesabi Range could account for two-thirds of the ore consumed by this country's steel industry.

(b) Foreign Ores. Based on present knowledge, it appears that foreign ores represent the next cheapest and probably the largest single source of iron ore for the nation's steel industry 30 years from now. They also represent the largest risk factor. The risks are obvious. I am not speaking here of Canadian ores but rather of ores from South America. These South American ores have a very high iron content and very low production cost, but there is always a possibility of expropriation or governmental interference. In case of war, there is the constant threat of enemy action on the 2500-5000 mi. of open sea. In spite of these

hazards, it appears now that the steel and iron ore industries will take the risks and, unless a shooting war develops, probably between one-third and one-half of the foreign ore used by the United States in the future will come from South America.

Canadian ores, including those of Labrador, will probably supply as big a part as South America in the years to come. While this ore will not be as high in iron content or as cheap to produce as South American ores, the risks are minor and consequently it is a much more assured source.

(c) Concentrates of Low-Grade Ore. We now come to the concentrates from low-grade ores. No one at this time can definitely predict their costs, but we have a general idea and we know that the costs we have will be improved as time goes on. Almost all the companies in the industry are spending considerable sums of money in research on low-grade ore development and in the next ten to fifteen years this should result in important cost savings.

So much has been written optimistically about taconite costs that I am afraid decades are being telescoped by enthusiasm. Eventually the cost of the product at Lower Lake ports should equal some of the more conservative predictions, such as the $9.53 per ton recently estimated by the Mines Experiment Station in "Iron Age," but this I believe is some years away.

One of the points that must not be forgotten in dealing with taconites is the enormous capital expenditure requirements. It costs about $30 an annual ton of capacity to develop a taconite mine and provide the necessary buildings and equipment, as compared with approximately $4 per ton for open-pit and $8-$12 per ton for underground. Taconite production is economically sound only when approached from the viewpoint of large-scale operations. This, of course, requires tremendous capital investment which results in many financing and depreciation cost problems.

Neverthless, low-grade ore concentrates must be considered as one of the primary sources of the nation's iron ore supply in the future. They are an assured source of ore and there is no risk involved, and for the steel industry, faced as it is with a tremendous requirement for ore, these are very important considerations.

(d) Lake Superior Underground Ores. There are at least 800-million tons of high-grade underground ores which should play an important part in supplying the country's steel industry. However, the development of deep underground mines to any major extent in the future will be retarded because of the increase in both development and operating costs.

The cost per ton of annual capacity for developing and equipping deep underground mines in the future is estimated at approximately two or three times that of the open-pit mines. This is not as important, however, as the difference in labor cost, which it appears will be between three and four times as much as that of an open-pit mine. Offsetting this in part in Michigan and Wisconsin underground mines are the lower transportation rates, lower taxes, and the lower royalty. Improved technology in underground mining and a realization by labor of the problems involved are both necessary for the full utilization of these underground reserves.

Where Is the Iron Ore Coming From?

We now turn to the question, "Where is the iron ore coming from?" The easiest way to follow this is on a chart, and a chart is presented on p. 80 showing potential sources of iron ore for this country's steel industry in 1960, 1970, and 1980 as compared with sources in 1942 and 1951. The broken black line indicates our estimates of steel capacity. We show it at 125-million tons in 1960—in other words, not much higher than it is now; in 1970, 137.5-million tons, and in 1980, 150-million tons.

I believe these figures are on the conservative side, as I have already pointed out. If the industry operates at the estimated capacity in the years 1960, 1970 and 1980, it is our estimate that the ore would come from the sources indicated.

This chart covers shipments of iron ore for United States consumption. For simplicity, I have assumed that all exports in 1942 and 1951 were from Minnesota and the chart is prepared on that basis. I have not assumed any exports in 1960, 1970, and 1980. Exports in 1942 were 2-million tons and in 1951 4.3-million tons.

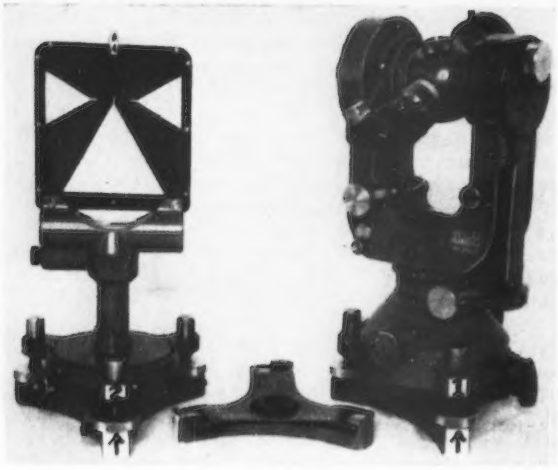
The lowest division of the bars, which represents Minnesota high-grade ore, shows a figure of 75-million tons in 1951. This will shrink to 20-million tons in 1980, and of this 20-million tons, probably only about 15-million tons will be open-pit ore. The second division of the bars, representing Michigan and Wisconsin high-grade ores, maintains a constant flow through the period of 15-million tons annually. Underground mines last 50 to 75 years and those in operation at the present time are relatively low-cost because they are not very deep and also were developed when capital costs were one-half to one-fourth what they are now. If labor-saving devices are developed, this figure of 15-million in 1970 and 1980 could increase to 20-million tons. Unless they are, I do not believe very many deep underground mines will be opened.

A New Era

The steel and iron ore industries of the United States are entering a new era as far as iron ore supply is concerned. The low-cost, direct-shipping ores of the Mesabi are being exhausted. In the next few decades primary dependence will be on foreign ores and beneficiated low-grade ores. Primary sources of foreign ores will probably be Canada (including Labrador) and Venezuela.

The concentrated and agglomerated low-grade ores will become the backbone of the domestic iron ore industry. The development of this product is still in its infancy, and while it undoubtedly has been over-glamourized as to its profit possibilities, technological advances in the next decade should make substantial reductions in costs.

It seems apparent that both foreign ores and the beneficiation of low-grade domestic ores will be higher-cost than our present open-pit operations. The development of these new sources of ore will require a tremendous capital outlay on a scale heretofore unknown in iron ore development. For the iron ore and steel industries to realize a fair return on their investment, the ingenuity of management will be taxed to improve technology, and, realistically speaking, probably an increase in the price of iron ore will result. In any event, the steel industry of this country can rest assured that the iron ore will be there to meet the increasing demands in the years to come.



INSTRUMENT AND TARGET used are shown. The theodolite is in position 1, the target in position 2.

Shaft Plumbing Method Improved at Mine in Sweden

KAUNO KANGAS
Mine Surveyor
Luossavaara-Kiirunavaara AB
Malmberget, Sweden

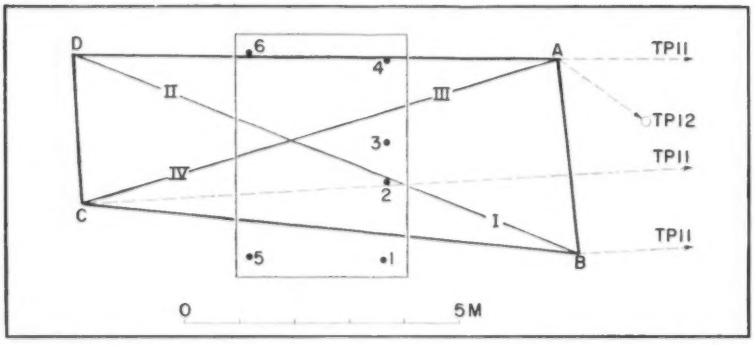


FIG. 1. QUADRILATERAL as measured at the Sofia shaft on 300-meter level in plumbing from this level to 350-meter level.

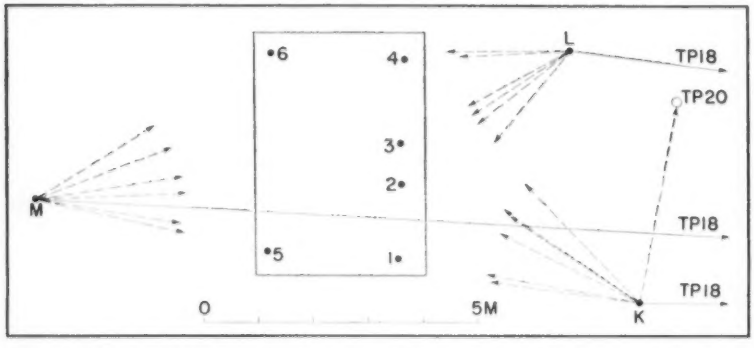


FIG. 2. RESECTIONS on 350-meter level of Sofia shaft in course of plumbing from 300-meter level above.

PROBABLY the most popular method of shaft plumbing today among European engineers is the triangulation or Weisbach method. Its popularity derives from its relatively simple procedure and generally sufficient precision. In Sweden, however, another method has long been employed and recently has been developed further in Malmberget so that it can stand comparison with other methods in respect to precision.

The Swedish shaft-plumbing method is based on the three-point problem, four or five plumb wires, however, being used to get extra determinations. Coordinates of the resection point are obtained by means of complete adjustment in accordance with the method of least squares.

First, the coordinates of the plumb wires have to be determined. This could be done by traversing, but ordinary taping is not sufficient. A complete quadrilateral, connected with the triangulation system, is measured at the shaft opening, the three-tripod system being used. Simultaneously with the observations in the quadrilateral, sights are taken on the plumb wires. Only one side of the quadrilateral has to be taped, to get the right scale of the measurement. Then the quadrilateral is first computed and adjusted by the method of least squares. The intersections are then adjusted. When the adjusted coordinates of the plumb wires are obtained, the underground resection can be calculated.

Constant Errors Eliminated

Even the most modern surveying equipment is subject to certain constant errors, influencing the measurement of the quadrilateral, some of the sides of which may be very short, at times only about 2 meters. We have therefore determined the instrument errors and developed methods to eliminate them.

Besides the well-known instrument errors, which can be eliminated by taking many sets of readings with the telescope in both positions, the following constant errors have been observed:

A. The vertical axis of the theodolite is eccentric in relation to the triangle formed by the three footscrews, which together with the footbase makes the basis of the three-tripod system. The eccentricity of the theodolite as to which the

investigation has been made (a Wild T2 instrument) is 0.2 mm.

B. The round plate of the upper revolving part of the target (see photograph) is eccentric in relation to the three footscrews.

C. The point sighted on is eccentric in relation to the round revolving plate.

Moreover the difference made by turning the upper part of the target may amount to 0.2 mm.

To eliminate all the errors mentioned, each footbase has been provided with an index arrow, and the footscrews of the theodolite and all the targets as well have been provided with the numerals 1, 2 and 3 (as shown in the photograph). Further, a little nib has been fastened on the middle of the upper part of the targets, which then is sighted instead of the point of aim in the center of the target glass.

When measuring the quadrilateral, the theodolite and the targets are first placed in position 1; that is, all footscrews numbered with the numeral 1 are brought above the index arrow. The direction method is used. To eliminate the errors mentioned in items A and B preceding, two sets of readings are taken for each position. Finally, to eliminate the error mentioned in item C, the targets are turned 180 deg. after each half set. Thereby the effect of the play will also be reduced to a minimum.

Due to the difficult conditions which often exist when plumbing a shaft, other precautions also have to be taken. They are partially dependent upon the local conditions and therefore require much experience for good results.

Shaft Plumbing in Practice

Two different shafts have been plumbed at Malmberget using the principles mentioned, both with such good results that they will be described here.

The first survey was made in the Hertig shaft by means of six plumb wires 130 meters long suspended from the surface down to the 300-m level. The shaft was very drafty and wet, and 0.6-mm piano wire and 30-kg plumb bobs were used. Six sets of readings were taken at each station point. Underground the greatest amplitude of swing was 0.9 mm.

Results are given in Table 1.

The second shaft plumbing was carried out in the Sofia shaft from the 300-m level (Fig. 1.) to the 350-m level (Fig. 2). The greatest amplitude of swing observed was 0.5 mm. The result is given in Table 2.

The average error ±1.7″ of the final bearing means that when finishing the driving of a drift 10 km. long one has to reckon with an average transverse error of ±8.5 cm; that is, the maximum error is 25.6 cm, which has to be credited to the shaft plumbing.

Table 1. Results at Hertig Shaft

Triangle closures before the adjustments:	I	+2.3″
	II	+4.5″
	III	+5.2″
	IV	+1.6″
In the total quadrilateral		+6.8″
Residual in the side equation before the adjustment:		+ 2.2 (6th decimal)
Average errors after the adjustment:		
	Quadrilateral	±1.4″
Plumb wire number	I	±1.9″
	2	±0.6″
	3	±2.9″
	4	±2.4″
	5	±1.2″
	6	±1.6″
Resection	E	±2.3″
	F	±4.6″

The resection E and F gave for the same traverse line two bearings which differed 4.1 sec. The weighted mean of these gets the average error m = ±1.8″

Table 2. Results at Sofia Shaft

Triangle closure before the adjustment:	I	+5.3″
	II	−1.1″
	III	+4.1″
	IV	+0.1″
In the total quadrilateral		+4.2″
Residual in the side equation before the adjustment:		+ 1.9 (6th decimal)
Average errors after the adjustment:		
	Quadrilateral	±1.2″
Plumb wire number	1	±2.9″
	2	±1.4″
	3	±1.3″
	4	±1.7″
	5	±1.9″
	6	±2.1″
Resection	K	±1.1″
	L	±3.2″
	M	±1.7″

Three different values were obtained for the bearing of a common long traverse line on the 350-m level. These are related to each other as follows:

From K	37°15′	5.2″ ± 2.6″
L	37°15′	11.9″ ± 3.9″
M	37°15′	6.1″ ± 2.8″
The weighted mean	37°15′	6.8″ ± 1.7″

The time required for all calculation work was 46 hr. 45 min.

Advantages of Method's Accuracy

In spite of the work involved in this shaft plumbing method, its use is obviously justified wherever reliable and extreme accuracy is demanded. The calculated average error gives a good idea of the accuracy of the work done.

At Malmberget, the work of plumbing the Hertig shaft has already given very good results in practice, verifying the reliability of the theoretical figures.

Between the Hertig shaft and the Vitafors shaft a drift 3 km long has been driven on the 300-m level. The connection was made 1.1 km from the Hertig shaft. On making the connection measurement, the real error of the bearing was found to be 0.6″ and the point error 5.8 cm. As the drifts met on a long straight course, it may be of interest to divide the error into two components of which the transverse error was 2.4 cm and the longitudinal error 5.3 cm.

At the Vitafors Shaft

Another example is the Vitafors shaft, which earlier was cut between the 250 and 300-m levels, will now also be opened between the 300 and 350-m levels. This will be done by driving a shrinkage stope of the same dimensions as the final shaft. The survey that was the basis of this important undertaking consisted of an about 1-km traverse on the 300-m level from the Vitafors shaft to the Sofia shaft, shaft plumbing to the 350-m level (already previously described) and again a 1-km traverse back to the Vitafors shaft. Theoretically calculated, the maximum error should not exceed 8.1 cm.

Recently the real error in the bearing has been determined. It amounted to 8.4″. To get the point error fixed with greatest precision possible a plumb wire will be suspended down to the 350-m level. The result cannot be given until later, as the shaft unfortunately will be filled with rock for some time. I have, however, reason to presume that the real point error is smaller than the theoretically calculated maximum error of 8.1 cm.

Owing to the good results obtained at Malmberget the shaft plumbing method described may be considered as one of the most accurate methods.

The Remarkable Case of the

Here's what happened:

Table 1. Improvements in Mill Performance Due to Decreased Ball Load

	NOW	BEFORE
Ball Load, tons	35	55
Ball Load, % volume	29%	45%
Tonnage	2250	2130
Horsepower Requirements	370	490
Ball Consumption, lb./ton	0.84	1.02
Grind: Sulphides—200 Mesh	65%	62%
Grind: Gangue—200 Mesh	35%	40%
Tails: Copper	0.068%	0.08%
Tails: Sulphur	2.5%	4.0%
Sod. Ethyl Xanthate, lb./ton	.28	.34

F. M. LEWIS
Mill Superintendent, at Tennessee Copper Co.'s Copperhill mills.

WHAT HAPPENED when the ball load in Tennessee Copper Co.'s huge Hardinge Tricone mill was reduced from 55 tons to 35 tons should give a lot of mill men food for thought. Not only did the reduced ball load make possible an increase in tonnage ground from 2130 to 2250, but power requirements dropped from 490 hp. to 370 hp. Nor was that all. As a result of the remarkable differential grind achieved (see table above), it has been possible to cut down on reagents.

Between August and October 1952 the amount of balls in the mill at Tennessee Copper's London plant was reduced from a load occupying 45% of the mill volume to a load occupying 29% of the mill volume. No other operating condition was changed. The mill turns over at 15 rpm (63% of critical speed), ball size is 1-in., average pulp density is 63% solids.

Results shown in Table I, were disclosed to a visiting *E&MJ* editor by Mr. F. M. Lewis, mill superintendent, who plans to experiment with further reduction in ball load in the near future. In addition to the lower ball consumption noted, it was possible to postpone an impending liner change because liner wear has been reduced.

Could the large classifying pool in this mill be contributing to these remarkable results? This pool has an area of about 70 sq. ft. and averages approximately 40-in. deep. The mill discharge is only 63% solids, but the material at the bottom of this pool, which must be the feed to the ball mass, is at least 75% solids. Also, this material is as clean as most conventional classifier sands. Thus only the coarse portion of the pulp in the mill, which has been thickened, ever enters the ball charge and in a very short time it is back in the mill pool for reclassifying.

Mr. Lewis doesn't know the answer at this time, but members of his staff are studying the conditions in their grinding circuit.

Copperhill Ball Mill

Here's what a few mill men think about it:

MILL MEN WE QUERIED about the facts on the opposite page were generally divided into two schools of thought. The first group seemed to agree that perhaps the classification taking place in the mill itself was responsible for the results achieved. Others were of the opinion that with the larger load of balls, power was being absorbed by balls contacting other balls with no particles interspersed; that is no grinding was being done by a goodly portion of the ball charge. With the reduced load more balls were effectively brought into play.

An eastern member of the milling fraternity, in discussing the situation by phone, felt that the key to the problem lay in the question; why couldn't the mill grind more ore with the initial large ball charge?

Another question that certainly needs an answer is; how far can you go in reducing the ball charge in the mill and receive further benefits?

Before we turn the floor over to some of the interesting specific replies, we'd like to invite your opinion and comment on the remarkable case of the ball mill at Copperhill.

B. S. CROCKER
Different ball loads have different critical speeds.

BUNTING S. CROCKER
Mill Superintendent
Lake Shore Mines Ltd.

THE RESULTS SHOWN in Table I are so remarkable that one hesitates to offer any suggestions as to what has brought about this effect. The Tennessee Copper staff are to be congratulated on having enough pioneer spirit to go ahead and try the experiments shown because, regardless of the explanation, they apparently are making a substantial overall saving in their operation at the present load and speed.

In reviewing Professor H. E. T. Haultain's (University of Toronto) pictures of various ball loads and mill speeds, I remember that it took less per cent critical speed to give the usual ball action with 20% loads than with 60% loads. (E. W. Davis also pointed this out.) Thus, in this test the original mill with 45% volume at 63% critical speed may not have been producing as suitable a cascading action (or ball path action) as the present mill with 29% volume and the same speed. Certainly the grind is more efficient as shown by the figures but from a grinding point of view, not quite as efficient as the tonnage and power shown, as it will be noted that the gangue grind (which is probably 60% of the mill feed) is coarser on the 200 mesh under the present set up. The sulphides, of course, are being preferentially ground and are finer so they are doing the right thing metallurgically. However, I would not have expected ball action to have made as much difference as is listed in this test.

At Lake Shore, under reduced tonnage, on a mill running at 81% of critical speed we recently cut the ball load with a resulting drop in horsepower but a falling off in grind and the overall efficiency of the mill was slightly less than before. It may be that the phenomenon recorded at Tennessee is common to slow speed mills only.

HARLOW HARDINGE
President
Hardinge Co.

I MADE SEVERAL observations as to the reasons why the improvement occurred in this mill as reported.

Decreasing the ball load increases the number of ball cycles per revolution. For example, ignoring the time of fall, just consider operating with a mill at 50% ball load; those balls on the outer rim make two cycles per mill revolution. A mill at 25% ball loading would cause the same balls in the same location to drop four times per revolution. It is noted that this mill is operating with a relatively dilute pulp. "Doc" Lewis also observed that the pulp density in the mill pool was considerably higher near the bottom of the pool than at the top, or near the surface. A decreased ball load will cause the ball charge to operate in a higher pulp density and on the coarser size fractions, which will cause more effective grinding and as the ball-to-ball contact is reduced due to granular particles coming in between the balls, ball consumption would also be reduced. Since the grind has remained practically the same but at a very considerable reduction in power, it also follows that the power could well have been consumed by ball-to-ball contact which would increase ball wear. The fact that the ball consumption has been greatly reduced would tend to bear out this line of reasoning.

Effect of Specific Gravity

It is well to bear in mind that this ore has a gravity of 4.2. The apparent gravity of this ore in the water would then be 3.2 as against a gravity of 1.7 of a 2.7 specific gravity ore. The settling rate, therefore, of this ore in a dilute pulp averaging 63% solids as against the 75% to 85% solids in most of the mill operations would cause the classifying action that apparently occurs inside this mill.

When the mill was first operated, as has been reported by the progress reports at Tennessee Copper, it was found that a high density pulp did not work out nearly as well as when the density was considerably reduced. Now, further reduction in ball load has improved the operation. This is counter to many other cases where a very high ball load has improved results. But, in those cases, the pulp density was

HARLOW HARDINGE
Don't forget the effect of slower speeds in high level pulp mills.

E. H. CRABTREE
Where did the additional copper come from?

J. F. MYERS
A mill 100 ft. in diameter would not grind eggs.

much higher; the specific gravity of the ore, on the average, was lower; and the average ball size was greater. Apparently, the pulp density was so high as to preclude the possibility of any classifying action occurring within the mill pool. The latest findings at Tennessee Copper by F. M. Lewis certainly should be of interest elsewhere, but in evaluating these interesting results, it is important that many factors be considered. Only some have been commented upon here. It is also important to note that this is a high pulp level type of mill run at lower than standard speeds, which makes possible the formation of a pool under the conditions existing here.

E. H. CRABTREE
Director of Milling
Eagle Picher Co.

ANY TIME A MILL MAN can simultaneously reduce costs and improve recovery, he is really doing something; usually one of these is done at the expense of the other. It appears that "Doc" Lewis is following well in the footsteps of his eminent predecessor, Jack Myers.

Few mills have the facilities to control conditions as carefully as does Tennessee. Those who can should certainly attempt to duplicate these results. It is apparent that, from a finer sulphide grind and a coarser gangue grind, more copper was floated with fewer reagents. But, at the same time, considerably more iron was floated, evidently resulting in a lower grade rougher concentrate. It would be interesting to know if this resulted in a lower grade final concentrate. In other words, was the additional copper recovered freed by the finer sulphide grind, or was it recovered by floating more copper-iron middlings?

JACK MYERS
Consulting Engineer

IF YOU WILL REFER to the "Progress Report on Grinding at Tennessee Copper Co.," AIME, Vol. 187, June 1950, page 707, you will note that in Table III, Col. 6 (authors Myers and Lewis) when treating 2,100 tons per day, 412 hp. input was recorded and that the minus 200 mesh sulphide grind was 73%. This is a considerably finer grind than the 65% and 62% reported by Mr. Lewis in Table I.

It must be remembered also that this mill is operating with 1-in. forged steel balls and that the feed to the ball mill comes from a controlling rod mill that produces a product all through 14 mesh.

It is unfortunate that all the screen analysis figures are not given. I rather suspect that the power used to produce the 73% minus 200 mesh sulphide, as reported in Col. 6, is very close to the power consumed with the low ball load figure of 65%, maybe better.

There is another point that shall be mentioned. The figures in Col. 6, previously reported, were made when the mill liners were quite new and plenty of lift was present. In the two columns given in your Table I, the liners were practically worn out. In fact, they were removed just a few days prior to a visit I made at Copperhill in early April. An examination of these worn liners shows that the characteristic grooves, generated in the liners caused by ball slippage or rolling are present. This always occurs after lifter effect is worn off.

It will be remembered that Wright Hargreaves and Lake Shore found that this grooving is beneficial in transferring effective power from the mill shell to the ball charge and that prior to their present "rock" grinding process, they installed liners with grooves cast in them. If I remember correctly, they found that grooved liners were more advantageous than lifters when using balls 1¼ in. or less. The T. C. mill uses 1-in. balls so it would seem to me that this fact should be considered in analyzing the T. C. results. Mr. Lewis now has new liners in the mill and will, of course, be able to report on this point at a later date. I do wonder if Mr. Lewis took into consideration the fact that at a given ball loading, a mill with old liners carries more ball weight than one with new liners. The data in your questionnaire do not make this point clear. I cannot check the 35 tons of balls reported in Col. 1 of Table I.

However, none of the above comments detracts from the value of Mr. Lewis' observation and we are indeed indebted to him for reporting his results and to the editors of *Engineering and Mining Journal* for bringing it to the industry's attention. It certainly is an interest-

ing fact that the ball consumption dropped from 1.02 to .84 lb. per ton, a matter of nearly 20%. This reduced consumption of grinding media was one of the objectives set up when the Tricone mill started operation in 1948. The saving never materialized until now.

There is no question that the mill is doing better work under the conditions reported with a low ball charge, the worn liners, ball size and speed conditions as they are.

I think the reduction in ball consumption offers the key to solving the question of why low ball load is more efficient. We know that there is slippage between the shell and first layer of balls on the uptake side of the mill and there is also slippage between each succeeding layer of balls.

Bond has done some work on this subject and thinks that something in the order of 15% of the power in the shell is consumed on the first layer of balls. From there on approximately 10% of the power that is left in each layer of balls is consumed by the following layer of balls. This finally brings us to some point in the charge where there is very little power left to do useful work. This is easy to see in moving pictures of test mills with glass ends and is often referred to as the neutral point.

After contemplating this fact, I made the statement a few years ago that a mill 100 ft. in diameter would not grind eggs. That is, unless the diameter of the ball size was not increased proportionately. I still think this statement holds good, at least no one can prove that it is wrong. This is interesting to think about as the trend is toward bigger and bigger diameter mills. There certainly must be some mill diameter where power efficiency falls off with conventional size balls due to the well known fact described above. We can only transfer power from the shell through just so many layers of balls. The size and type of balls will govern this factor.

It will be remembered that Garms presented a paper some years ago describing the slow speed mills at Hayden. He brought out the point that the center of his ball charge was composed of a "mushy" mass of small worn-out balls that he termed the "kidney." To my question of whether the power used in slushing around this mushy mass of little balls was doing effective work, he replied characteristically "They wear out don't they?"

So I think the explanation as to why Mr. Lewis' low ball charge is doing better work is simply this; he has by empirical means found the number of layers of balls that most effectively consume the power in the shell. With his 1-in., smooth, steel balls this is apparently not a very big load. With a high ball charge the power from the shell was being transferred through approximately the same number of ball layers, thus leaving a big "loblolly" of balls in the kidney that were doing very little or no work, but that were wearing away by corrosion. It is to be remembered that on the high sulphide content of the T. C. ore corrosion is a large factor. Between the shell and the ball mass there is a drop of potential of .26 v.

I do not think that the large classifying pool is a contributing factor in this case. If you will again refer to the "Progress Report," AIME, Vol. 187, on pages 710 and 711, you will find in Tables IV and V a lot of information on this subject. The classifying effect was just as complete then as now, and no such improved efficiency developed as is now reported.

As for the lower xanthate consumption with the low ball charge, it follows that the lower ball consumption and a proportionately smaller amount of products of corrosion, require less xanthate to overcome the corrosion salts. This would definitely tend to improve the loss of copper and sulphur in the tailings. This I think is quite obvious unless it is known that the quantities of the products of corrosion are the same in both cases, which I doubt.

ADRIAN DORENFELD
Assistant Professor
of Mineral Dressing
University of Alabama

I BELIEVE that the explanation given is essentially correct. However, insofar as I can remember, the Tricone mill turns at a low speed—thus, there is little cataracting of the ball mass. Hence, having the large mass of balls (previous practice) did little good since the balls were grinding, near the center of the mill, already well ground and essentially finished material. Power was being consumed, as well as balls, with little gain.

The fact that liner wear is substantially less may be due to less weight of balls against the sides of the mill, so that balls do not come in contact with the liners as much as before. Of course, this is all predicated on recollection that the Copperhill mill does not cataract.

I believe that the findings at Copperhill mean that the new mill needs a different technique in operation—since the ball mill is not a conventional one, there is the possibility that the operating technique may not be conventional either!

What's Your Opinion?

If you have any comments on this Copperhill story, or if you have had a similar experience somewhere, *E&MJ* will welcome your contribution to a general discussion of this article. Please address your comments to:

The Editor
Engineering and Mining Journal
330 West 42nd St.
New York 36, N. Y.

T. M. MORRIS
School of Mines and Metallurgy
Rolla, Missouri

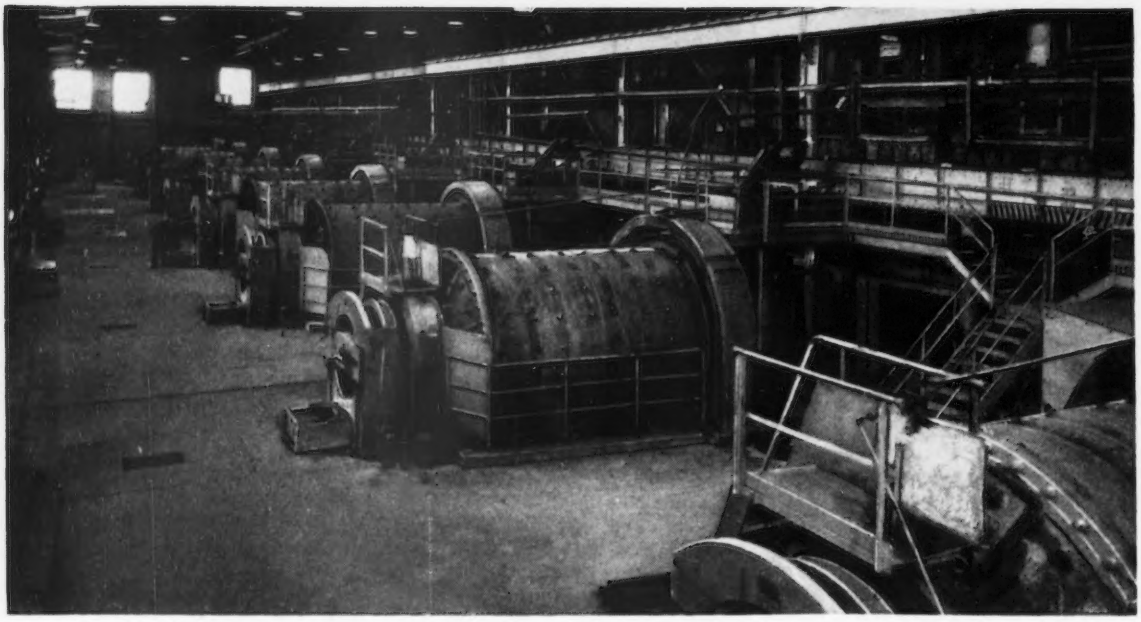
THE RESULTS SHOWN are certainly interesting. I do not know of any other operation in which tonnage ground through a given mesh increased as ball load was decreased below 45% of the mill volume.

I think that it would be worthwhile to know if the ball size distribution was the same after the ball load was decreased as before this change was made. In many grinding operations a very noticeable increase in tonnage through a given mesh has been obtained when the ball size distribution was changed. This may be a factor causing the improvement.

The increased pool area in the mill would augment the Hydroscillator pool area and should help the grinding. Previously reported data indicated that the return sands from the Hydroscillator were quite clean and hence it would seem as though increased classification capacity would not be wholly responsible for the results obtained.

Sequel

When Mr. Lewis has the opportunity to complete his investigation of the operation of his Hardinge Tricone mill, including further reduction of the ball loads, he has kindly agreed to publish the results. We are looking forward to another of the contributions to milling science which have become practically a tradition with the mill staff of Tennessee Copper Co.



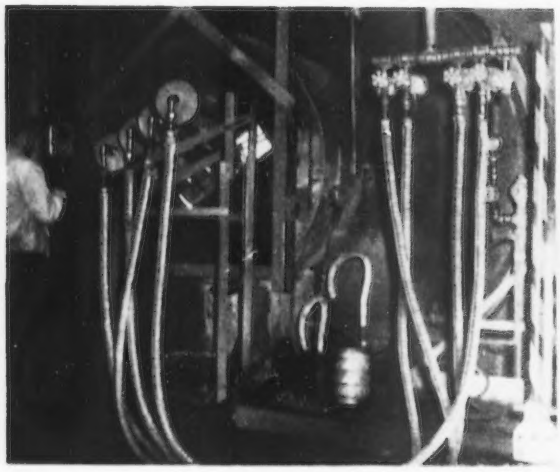
MODERNIZED GRINDING UNITS, including these Marcy rod mills, handle straight sulphide ore and also grind scoured and deslimed sands from oxidized ore produced in Greater Butte Project's block-caving operations.

How New Leach-Float Plant

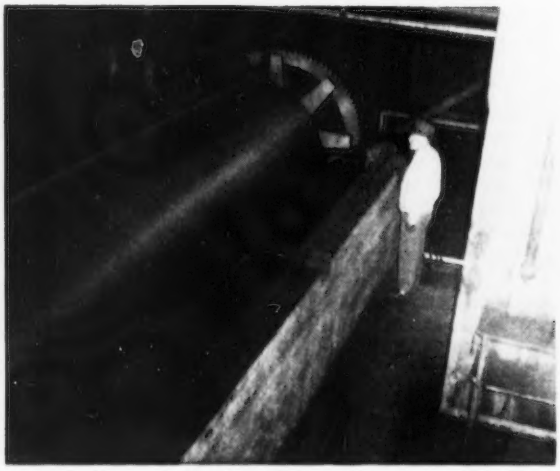
This second installment of Mr. Huttl's Greater Butte progress report outlines the Project's leach-precipitation-float technique. Anaconda's block-caving operations at Butte were described in our April issue

JOHN B. HUTTL
Associate Editor

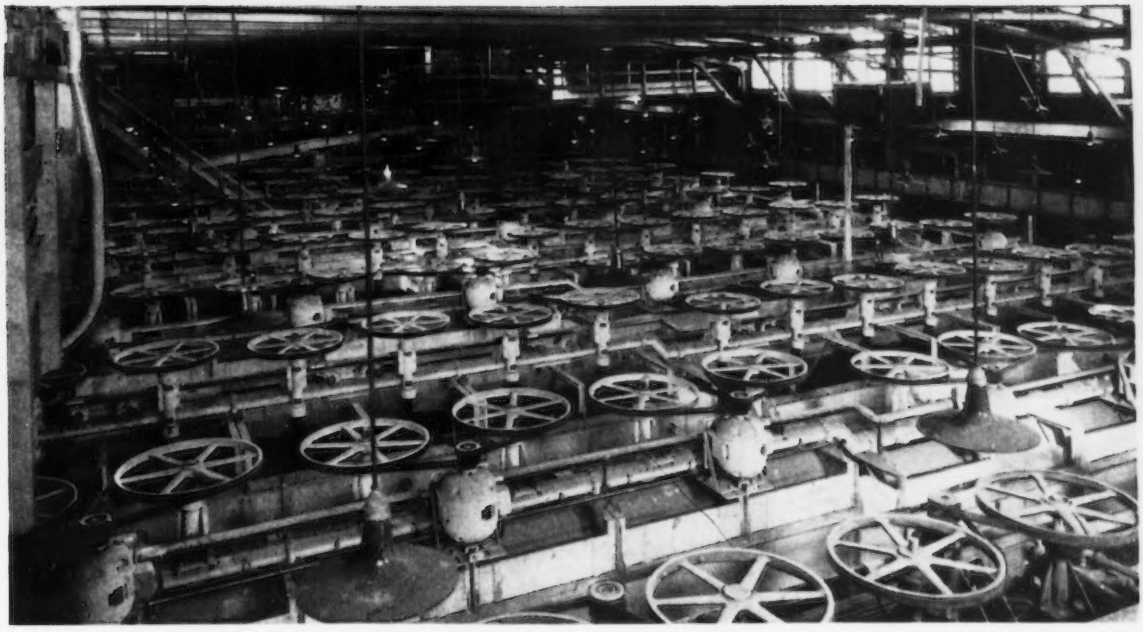
ORE OBTAINED FROM the Greater Butte Project's 600 level, where oxidation has progressed to a marked degree with the development of considerable copper and iron sulphates, is brought to the reduction works at Anaconda by



FIRING END of natural gas-fired Bruckner-type rotary furnace, producing sponge iron for copper precipitation.



COOLER brings hot sponge iron down to 150 deg. F. J. H. McCrea, assistant superintendent, checks operation.



REMODELED FLOTATION SECTION, where Agitairs give lime-xanthate float to sulphide ore and oxide ore sands, and also treat Project ore slimes by flotation, following precipitation of copper by adding sponge iron.

Handles Greater Butte's Ore

the B. A. & P. R. R. in trains of 50-ton cars.

Treatment at the remodeled copper concentrator involves two-stage crushing to 1¾-in., and scouring and desliming in large scouring mills and drag classifiers. The clean sand goes to a conventional lime-xanthate flotation circuit, and the slime containing most of the oxide copper, soluble copper, and deleterious leachables from wood and ore goes to a special leach-precipitation-float plant using sponge iron as a precipitant.

Operating results check closely with comprehensive experimental and test work conducted for a period of five years. The process units are arranged as shown in the flowsheets.

Equipment available at the crushing plant for reducing the oversize and undersize from two rail grizzlies consists of two 20-in. gyratory crushers, two 5x12-ft. vibrating screens with 2¼x5-in. openings, and two 7-ft. Symons cone crushers.

Of the eight mill sections installed in the copper concentrator, each capable of handling more than 2,000 tons of ore a day, three are set aside for regular sulphide ore and five for Project ore. Only four of the latter sections are required to handle a daily feed of 8,230 dry tons. Total copper content of the Project ore currently treated averages 1.10%. Oxide copper amounts to about 0.18%. Specific gravity of the ore is 2.80.

The drag classifier operating with each scouring mill consists of a wooden tank and two 24-in. belts upon which rakes are mounted at 12-in. intervals. Rake lips and bolts are made from special bronze. The belts operate at a speed of 60 fpm.

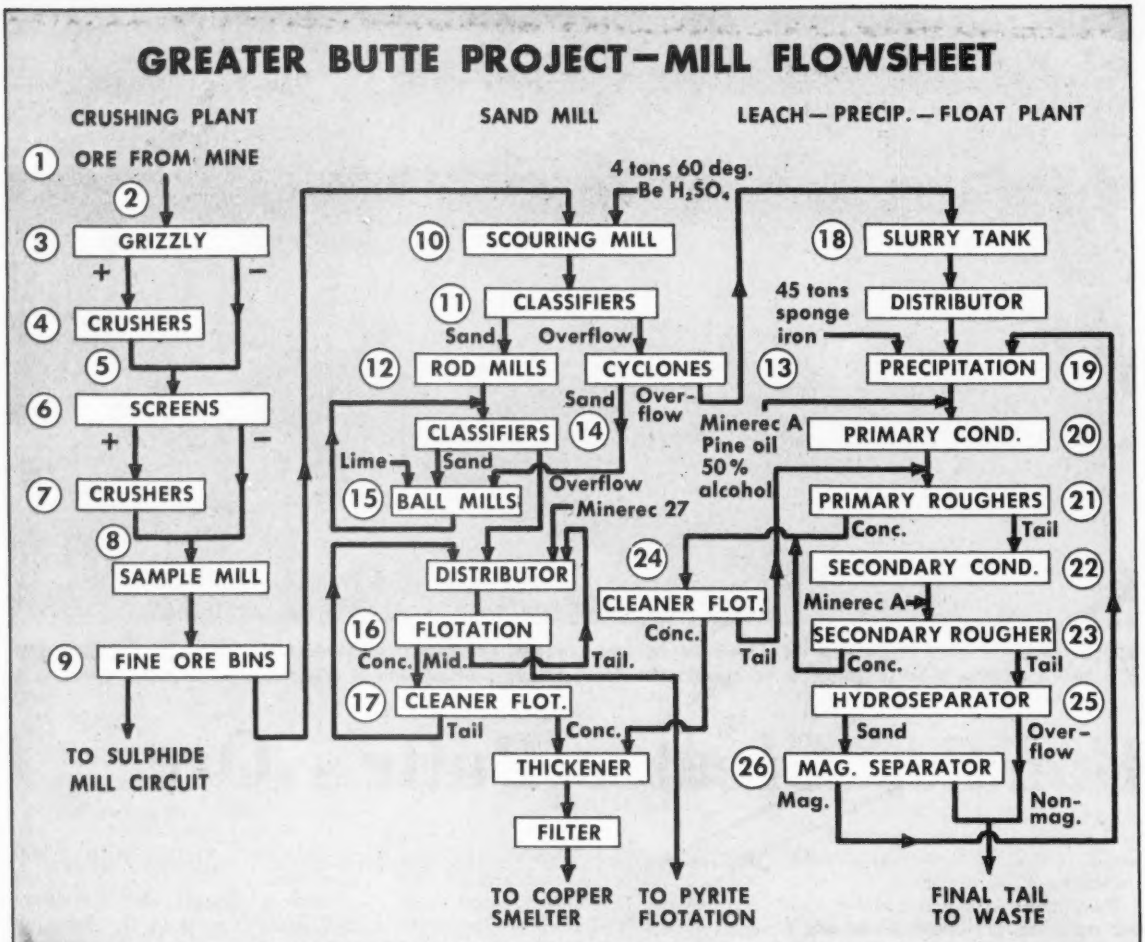
Water used in scouring is so adjusted as to produce a slime containing 15% solids, and 60 Bé sulphuric acid is added at a rate to give a solution running about 2 pH, or 12 tons for the 8,230 tons of ore handled a day. About 70% of the oxide copper is dissolved in the scouring mill leach. No leach extraction is obtained from mine filling. Copper in solution averages 1.10 g/l, and the percentage of copper in the slime solids is ±1.42. Of the total tonnage treated in each scouring mill-drag classifier circuit some 19% results in slime, or L-P-F plant feed.

In each sand treatment circuit the sands from the drag classifiers are first ground to minus 10 mesh in a rod mill, and then to 19% plus 65 mesh in three ball mills operating in closed circuit with spiral classifiers.

Overflow from all classifiers (25% solids) goes to the flotation department which consists of eleven banks of 14-cell, 48-in. Agitair flotation machines. Five to six cells of each bank produce rougher concentrates; nine to eight cells, middling; and the combined tailings go to pyrite flotation.

The combined rougher concentrates are cleaned in one 14-cell Agitair flotation machine. Milk of lime is added to the rod mills, and the distributor mentioned receives the following reagents: Minerec 27 (0.02 lb. per t.) and frother (0.07 lb. per t.). Middlings and cleaner tailings are returned to the distributor. Finished concentrates assay 15% copper; 10% insoluble; and 40% FeO. Copper content in the tailings is 0.17%.

Save for six to eight cells of each bank of flotation machines making concentrates, eight to six cells middling, the rougher concentrate cleaning step, and addition of Minerec 27 (0.03 lb. per t.), reagent 404 (0.03 lb. per t.), and frother (0.05 lb. per t.) to the distributor, practice in the regular sulphide ore circuits is identical to that in the sand circuits described. Here, con-



LEGEND

1. Plant capacity is about 10,000 wet tons Project ore daily. Ore carries 4% moisture, 1.1% total copper, 0.18% oxide copper.
2. Cars carry 50 tons each, pass through 40-ft. rotary car dumper; ore goes through 54-in. pan feeder to 60-in. conveyor belt to grizzlies.
3. Two rail grizzlies, 5-in. spacing.
4. Two 20-in. gyratory crushers.
5. Belt conveyor, 42-in.
6. Two 5x12-ft. vibrating screens, 2½x5-in. openings.
7. Two 7-ft. Symons cone crushers, 1-in. setting.
8. Belt conveyor, 42-in.
9. Eight 1,000-ton, circular, steel fine ore bins.
10. Sand mill has five sections, with four operating at any given time. Each section has a scouring mill, 10x20-ft., with 6-in. Silex brick lining.
11. Five drag classifiers, four operating.
12. Five 9x12-ft. Marcy rod mills, four operating, treat 100 tons per hr. of 20% plus 1-in. feed. Discharge ground to minus 10 mesh.
13. Three 24-in. Dorrclones, fed by two SRL 10x8-in. pumps, discharge 1,232 tons of slime daily.
14. Thirteen 72-in. Akins classifiers, eight operating. Overflow is 19% plus 65 mesh.
15. Thirteen 10-ft. x 48-in. Hardinge ball mills, eight operating.
16. Eleven banks of 14-cell, 48-in. Agitair machines.
17. One bank of 14-cell, 48-in. Agitair cleaners.
18. Slurry tank, 50x12-ft.
19. Two banks of 14-cell, 48-in. Agitairs, with 60% excess depth. Each cell is 66 cu. ft. in volume.
20. Twelve 48-in. Agitair conditioners.
21. Thirty 48-in. Agitair primary roughers.
22. Six 48-in. Agitair secondary conditioners.
23. Twenty 48-in. Agitair secondary roughers.
24. Ten 48-in. Agitair cleaners.
25. Hydroseparator, 24-ft.
26. Crockett magnetic separator.

centrates containing 24% copper, 12% insoluble, and 29% FeO are produced. Tailings going to pyrite flotation assay 0.22% copper.

The combined slime pulp from the four scouring mill-drag classifier units flows by gravity to a slurry tank (1 hr. holding time) at the head of the L-P-F plant. Treated pulp then goes to two banks of fourteen, 48-in. Agitair precipitator cells. To them, about 45 tons of sponge iron is added daily by four special feeders to cells 4 and 6.

The sponge iron has a metallic iron content of 50%. Sulphuric acid is added ahead of the distributor. Contact time in the precipitator cells is 10 min. From the precipitator cells, the pulp is pumped to twelve primary conditioner cells

receiving the following reagents: Minerec A, 0.3 lb. per t.; pine oil; and 50% alcohol, 0.2 lb. per t.

Rougher flotation is carried out in thirty, 48-in. Agitair cells (contact time 7 min.), the concentrates being cleaned in ten, 48-in. Agitair cleaners, making a final concentrate assaying 18% copper, 11% insoluble, and 39% FeO.

Tailing goes to six, 48-in. Agitair secondary conditioner cells (contact time 1.5 min.), serving twenty, 48-in. Agitair secondary rougher cells (contact time 5 min.). The secondary conditioner cells receive the reagents Minerec A and PPO.

Concentrates produced by the secondary rougher cells are treated in the ten cleaner cells mentioned, and tailings go to a 24-ft. hydroseparator. The 40% solids spigot product from this unit is handled in a Crockett magnetic separator, with the magnetic material (about 100 tons a day) being returned to the precipitator cells and the nonmagnetic material, together with the hydroseparator overflow, going to waste. Tailing from the cleaner cells is pumped back to the primary rougher cells.

Operational control includes taking pH recordings at several points in the plant, and color assays on solutions from precipitator cells. A second hydroseparator unit is in course of installation to increase settling area and improve recovery of magnetic material from tailing, with another magnetic separator on order.

Sponge Iron Plant

At the Anaconda reduction works a fortuitous combination of favorable conditions exists for the production of sponge iron. For instance, at the works are available a high-grade iron calcine resulting from the roasting of a pyrite concentrate for the production of sulphuric acid, a dependable supply of a good grade of natural gas and slack coal, both at reasonable prices.

The plant constructed and in operation near the copper concentrator has a capacity of 40 tons of sponge iron a day. Details are shown in the accompanying flowsheet.

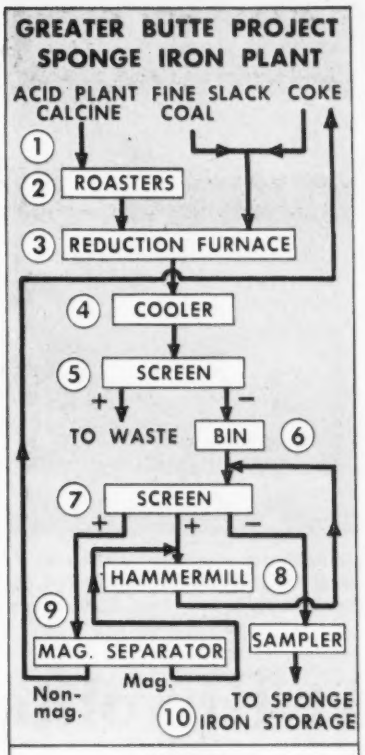
Briefly, the iron calcine from the chamber acid plant is reroasted first and preheated at 1,500 deg. F. in a revolving Bruckner-type furnace. Raw calcine contains 60% iron and 3% sulphur, the latter figure being reduced to 1% during reroasting operations.

The hot product is dropped into another Bruckner-type reduction furnace. As the reroasting unit, it is lined with firebrick (9 in. and reroaster 6 in.), and fired with natural gas. Reduction takes place at 1,900 deg. F. under the following reaction equations:

$$C + O_2 \rightarrow 2CO$$

$$Fe_3O_4 + 4CO \rightarrow 3Fe + 4CO_2$$

Volatile material is driven from the coal and the mixture of coke and calcine is heated to 1,900 deg. F. in the 30-in. deep bed of the furnace. At this temperature the iron is reduced to the extent of 85 to 90% by carbon monoxide resulting from reaction between coke and carbon dioxide. The surface of the charge is well covered by blue flames of carbon monoxide.



LEGEND

1. Calcine is roasted pyrite concentrate from acid plant. Raw calcine contains 60% iron, 3% sulphur; reroasting drops sulphur to 1%
2. Bruckner-type re-roasting furnace with 6-in. firebrick lining; speed 1 rpm, temperature, 1,500 deg. F.
3. Bruckner-type furnace, 10x20-ft., 9-in. firebrick lining; 1 rpm, 1,900 deg. F.
4. Baker rotary cooler, 5x35-ft.
5. Vibrating screen, 2x4-ft., ½-in. openings.
6. Crude sponge iron storage bin.
7. Double-deck Hum-mer screen, 4x10-ft., 14-mesh and 35-mesh openings.
8. Jeffrey type A-2 hammer mill, 30x24-in.
9. Stearns magnetic separator, 2-ft. drum.
10. Finished sponge iron carries 70% total iron, 50% metallic iron.

Boring Bar Used

To control the formation of accretions on the reduction furnace an 8-in. boring bar, water cooled, with a scraping knife mounted on a movable bridge, is available on the furnace floor.

The hot reduced product is discharged from the end of the furnace through a chute maintained under reducing conditions by means of raw natural gas to avoid reoxidation of the iron. It is then sent to a Baker cooler sealed at both ends from air entry. This is a revolving steel vessel cooled externally by water, measuring 5 ft. in diameter and 35 ft. long. About 10 min. are required to reduce the hot furnace product to 150 deg. F. so that it can be discharged safely, without danger of reoxidation.

The product discharged from the cooler goes to a vibrating screen with ½-in. openings, the undersize going to the crude sponge iron storage bin, and the oversize to waste. Stored material is passed over a double-deck Hum-mer screen, with one deck equipped with a 14-mesh screen and the other with a 35-mesh screen.

Magnetic Separation

The plus 14-mesh material from the screen goes to a magnetic separator, the minus 14 mesh plus 35 mesh to a hammer mill, and the minus 35 mesh to a sampler and storage bin for the finished sponge iron product.

The magnetic material from the magnetic separator is reduced in the hammer mill, and the nonmagnetic material goes to the coke storage bin at the head of the plant. Material crushed by the hammer mill is returned to the Hum-mer screen. The sponge iron sent to the L-P-F plant has a total iron content of 70%, with 50% in metallic form.

E&MJ expresses its appreciation to Chester H. Steele, vice president in charge of western operations, and to all members of his staff at Butte and Anaconda for the cooperation and help given in preparing this progress report on the Greater Butte Project.

FOURTH OF JULY always meant a drilling contest in the old days. Here are Mr. Richie, author of this article (with the hammer), and his partner, Fred Sander, at Tonopah, July 4, 1909, four years after the events described below. They took second money. Mr. Richie later took first prize in the single-hand contest the same day.

Boom At Rhyolite—1905

Here's how it was at one of the fastest-growing and quickest-to-die boom towns of the Old West, written by a man who saw it happen

ATHA ALBERT RICHIE
Rialto, Calif.

Mr. Richie, one of our favorite authors, won fame in the hey-day of Nevada mining by winning 13 out of 15 single-jack drilling contests on as many Fourth of July's. If you missed his account of those drilling contests, which appeared in E&MJ *for November, 1951, it will be well worth your while to go back and read it.*

I WAS REALLY HEADED for Rhyolite when I left the little copper mining camp of Holmes in southeastern Wyoming on Feb. 14, 1905. I wanted to go to Tonopah, Nevada. It was my third trip to the place, and I liked it there. I didn't know I was really going to Rhyolite because I'd never heard of it. The town got started just about the time we got there.

On this trip, I had not been in Tonopah but a few hours when I met up with Harry Clark, for whom I had worked the year before at a place called Timber Hill, not far from where the town of Manhattan is now.

Clark was all pepped up about a new strike in the southern end of Nye County near a place called Bullfrog. It was about 100 mi. from Tonopah but in the same county. Nye County must be about the longest county in the United States.

He wanted me to go down there and work for him, and I having been bitten by the bug that makes boomers or desert rats out of normal men, said I'd go. My partner, Sam, who had come from Wyoming with me, said he'd go too.

So we went down to the feed yards looking for transportation, and we ran on to an old codger that had a good team. He said if we could get a party of five together, he'd take us down to Bullfrog for $25 apiece. This old chap went by the name of Montana, and long after, when the Tonopah-Rhyolite railroad came in, they had a station called Montana, where this old fellow had started a roadside ranch.

We went uptown and found three other boomers, and we all took our warbags and bedrolls and dumped them into Montana's wagon, and we were off for this new camp of Bullfrog.

The first night out of Tonopah we stayed in Goldfield, in fact we stayed there two nights. On the way we must have passed around 20 string teams with from eight to 20 animals to the team, hauling supplies to Goldfield and on to the new camp. At that time the railroad was only in as far as Tonopah.

The first night out of Goldfield we were supposed to stop at what people called "The Tanks." Along towards evening I had been looking out for tanks like those along the railroads, but come to find out The Tanks were just depressions in the malapai rock, where snow water had drained in during the winter. One of them covered an acre or so and was about four ft. deep. The water wasn't cold, but it was good.

We got to Bullfrog on the third day. It turned out to be more of a townsite boom than anything else, being promoted by Harry Clark, who later on came to be known as Bullfrog Clark.

We hadn't yet unloaded our bags when I met up with one Bliss Robinson, with whom I had worked in a shaft the year before, and he told us the mines were all up the valley. He pointed out a large tent that he said was Welch and Lindsey's

saloon, and he was sure the town was going to be up there. People were calling it Rhyolite.

Montana said he had to go on up there anyway to get water for his team, so we went on up to Rhyolite. My partner and I unloaded our traps and set up tent, and we lived there for the next several months.

It is 48 years last February since we landed in Rhyolite, but as I recall, there weren't more than a dozen tents in the town at that time. The Welch and Lindsey saloon was a tent boarded up about 3 ft. on the sides, and with rafters over which the tent was stretched. It was about 20x40 ft. and had a board floor. The bar was a camp-made affair of planed lumber. Sam Lindsey afterwards got to be county supervisor.

Happy and Snowshoe

That night I met up with Jack Owen and he asked us to go out next day and help build some monuments on some claims he'd staked. While we were building these monuments, I met those two old cronies who were probably better known at that time than any other two men in Nevada. I mean "Happy Jack" and "Snowshoe Charlie."

These two old birds were watching us put up the monuments, and there came a most unusual thing for that desert country, a thunder storm. There were several loud claps of thunder and Charlie put his hand up to his ear and said "I wonder who's doing all that blasting off there?"

"Don't you know?" says Jack, "That's our Saviour doing up his annuals."

Snowshoe Charlie was a big man and he had drilled in the contests in Colorado. As the Fourth of July drew near, I heard a fellow ask Charlie if he intended drilling on the Fourth. Charlie said, "No, sir, I am not. I have exhibited my undershirt to the multitude for the last time." Happy Jack later got to be county treasurer and also served a term as sheriff of Nye County.

I've never seen anything like Rhyolite for mushroom growth. By the first of May there must have been at least 2,000 tents, all of them on an area no bigger than about 25 acres. I would come out of the mine at 10 o'clock at night and eat my lunch on the dump and there was a light in every tent. It was one of the prettiest sights I ever saw.

I don't want to forget to mention the rain storm that came up along in April. It just kept on raining for about three days, and before it ended, the wind came with it. That old desert was soaked up and soaked down, and when the wind came up and hit those tents, the pins just pulled out of the ground and the tents went flat.

I had an 18-oz. tarp to roll my bed in and when our tent went over, my partner and I grabbed our clothes and put them under the bed. In the excitement, I overlooked my John B. and the next morning it was gone and I never did find it.

When I showed this story to my friend Professor Carpenter at the University of Nevada, he said, "Atha, what's a John B?"

I said, "I thought every old-timer in Nevada would know that. My John B. was my hat, for John B. Stetson."

When we got out next morning, what a sight! Rhyolite was flat on the ground. The Welch and Lindsey saloon, because of the floor and rafters, was still standing, and so was French Louie's laundry, which was built on the same plan. The saloon was crowded and the mud on the floor was three inches deep. With it all, everybody seemed to be happy, and most everyone was laughing about his predicament.

Eggs In The Rain

Sam and I went down to get breakfast, and the cook was frying ham and eggs with the rain drops sputtering in the ham grease and water dripping off his hat into the skillet. I will say that with the exception of the burning of Rawhide, I have never seen such devastation.

Now I don't want to forget to mention another result of the storm. I have never seen such a variety of beautiful wild flowers as came up after the rain. There were Mariposa lilies, both the red and the blue, and dozens of others of every color. Whole hillsides were just a mass of color that you could see for miles. I'd like to be on the desert again in such a rain, just to see the flowers. Of course, they didn't last long, either in the ground, or in the tents when we picked them.

We had no post office in the early days of Rhyolite. There was a blacksmith named Bill Parker who opened up the first store, and all the mail that came in went right over to Parker's shop. Bill would dump the letters into an old grocery box, and then he would get up on another box and read off the names on the envelopes. Any letters that were left over after the crowd had gone, Bill would put outside the store in the box for anyone to look over. I suppose that when the pile of letters and papers got too high, Bill would take some out and touch a match to them.

The first funeral in town was to me one of the most pathetic. There was a young fellow named Curley working in the same hole in the ground with me. He had come out from Nova Scotia with his sister. She had stayed up in Tonopah to work. Curley took sick one day and it turned into pneumonia. We took care of him until a young doctor came to town and looked after him, and then someone got word to his sister. She came down and nursed him, but he was beyond help.

Starting A Cemetery

The Miners' Union took care of the funeral. Some of the miners made a coffin, and we laid Curley to rest down below town in the new cemetery.

Charles McKinnon conducted the services. He later became president of the Goldfield Miners' Union at the time of the strike when the troops were sent in there. He married Bill Haywood's sister-in-law. Llewellyn Blewett helped at Curley's funeral, too.

I had a letter from Llewellyn a few years ago. He and his two brothers were camped at Beatty, just over the hill from Rhyolite, and were prospecting there.

The ground at the Rhyolite cemetery is full of rocks from the size of your fist on up. When we started dropping that stuff on Curley's coffin, it was one of the awfullest sounds I ever heard. Curley's name was Daniel Kennedy, and his sister had a nice marble headstone put at his grave.

The second man to die in Rhyolite was named Hughes. He was laid right close to Curley.

Some time later, Jim Clayton and another miner met in one of the Rhyolite saloons and walked toward each other shooting, both, as it turned out, with pretty good aim. I knew Clayton well at Tonopah before Rhyolite was started. He was the only red-headed man I ever knew who married a red-headed woman. Mrs. Clayton put up a very nice granite headstone over his grave.

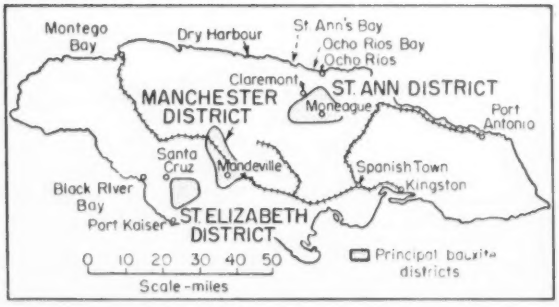
Those boom mining camps held Fourth of July celebrations the likes of which I've never seen elsewhere. The first Fourth in Rhyolite was a dinger. I'm sure no one who was there ever forgot it.

(Continued on page 190)

BAUXITE IS LOADED with Marion 3½ and 4½-yd. dippers into 15-ton rear-end dump diesel-powered Euclids

FOR ORE IN POCKETS, Marion draglines with 3½ and 5-yd. buckets often do the loading job most efficiently

Kaiser Aluminum Starts Shipping



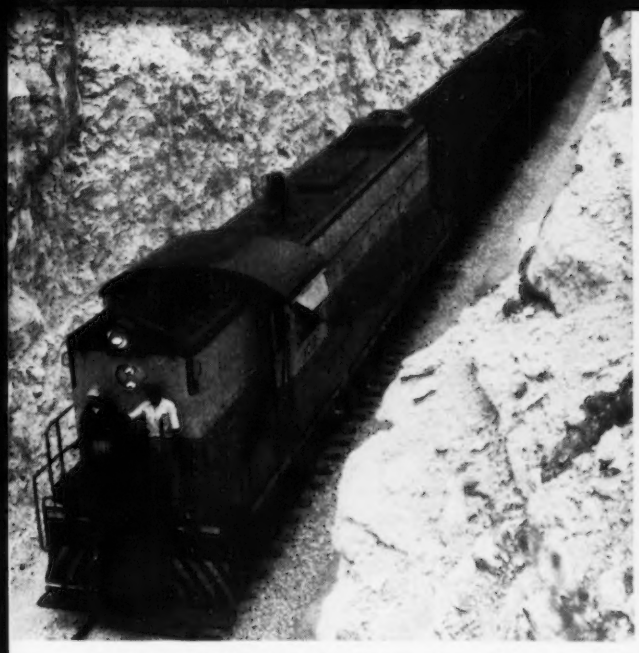
FIRST 10,000-TON LOAD of bauxite left Port Kaiser in mid-February. Kaiser's holdings are in St. Elizabeth Parish

KAISER BAUXITE CO., subsidiary of Kaiser Aluminum & Chemical Corp., formally opened bauxite mining operations on the island of Jamaica, B. W. I., in mid-February when the S. S. Evanthia left Port Kaiser for the company's processing plant at Baton Rouge, La., with the first 10,000-ton shipment of ore in its hold. The new bauxite facilities costing some $12-million were designed and constructed by Kaiser Engineers and as built and operated, will consolidate Kaiser Aluminum's position as a completely integrated aluminum producer. Bauxite from Jamaica has a comparatively short haul, about 3½ days, to Baton Rouge, La., where the company processes all of its ore into alumina to supply its primary aluminum plants at near-by Chalmette, La., the nation's largest aluminum reduction plant scheduled for completion in mid-year, and Mead and Tacoma, Wash.

The primary facilities and initial mining operations situated on and near the southwest coast of St. Elizabeth Parish will have an annual capacity of 2-million tons plus. Company holdings cover some 19,000 acres of bauxite reserves, sufficient to supply Kaiser Aluminum's expanded operations for an estimated 50 years. The Jamaican bauxite enterprise is the result of several years' exploration on the island, which has one of the greatest known bauxite reserves in the world. Initial tests revealed that Jamaican bauxite differed chemically and physically from ore used by the aluminum industry in the United States, and that an optimum yield of alumina could not be obtained by existing processes. Research laboratory results indicated that successful treatment of the available ores was practical, and these findings were verified in a pilot plant built at the Baton Rouge plant site and operated for more than two years.

The bauxite deposits are mined by open pit methods, with Marion equipment designed for both shovel and dragline operations used for actual mining and loading of the ore. In some places where the ore is found in pockets the shovel attachment is used until pit depth has reached shovel limits, followed by a switch to dragline to complete mining of the pocket. Equipment available at the mines include Marion's 93-M employing 3½-yd. dippers and 3½-yd. buckets, and Marion 111-M units with 4½-yd. dippers and 5-yd. buckets. Haulage from the pits to the railroad sidings is done by 15-ton Euclid rear-end-dump, diesel trucks. For auxiliary work, road building and maintenance bulldozers, road patrols, graders, and others are used. Mine ore is hauled to the ore handling, drying and storage facilities at Port Kaiser over 13 mi. of private standard-gage railroad in trains made up of twelve 70-ton gondola cars drawn by 1,200-hp. Baldwin diesel-electric locomotives.

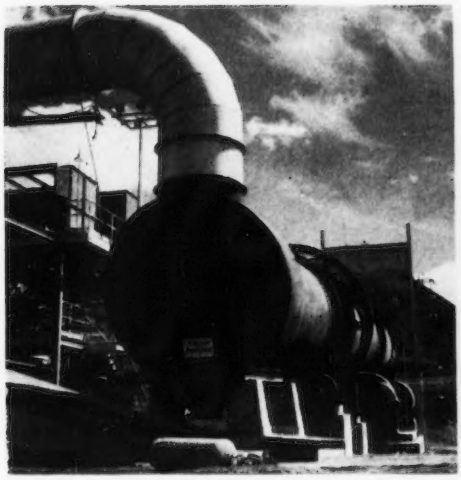
In searching for an economical method to move mined bauxite to Port Kaiser, Kaiser Engineers con-



TRUCKS DUMP BAUXITE into these 70-ton gondolas for 13-mile haul by 1200-hp. Baldwin diesel locomotives

ROTARY DUMPER empties cars into hopper feeding the first unit of a 3,100-ft. conveyor belt at Port Kaiser

Jamaica Bauxite to U.S.A.

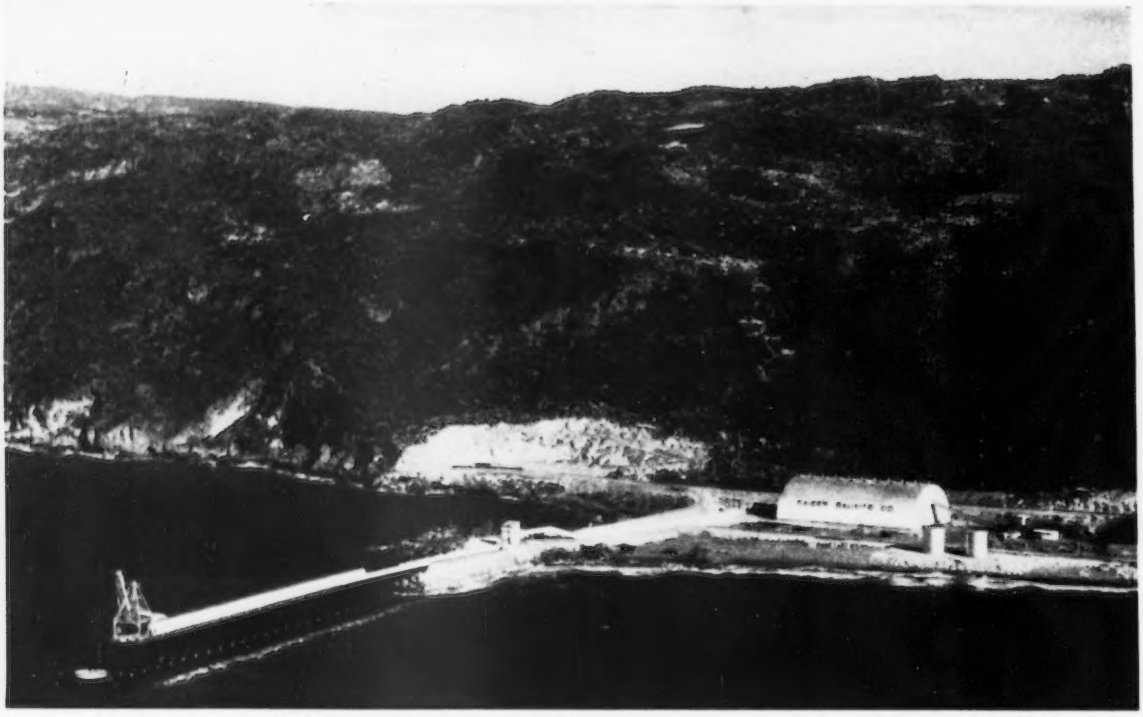


BAUXITE IS DRIED in this 18x90-ft. Hardinge rotary dryer using Bunker C oil for fuel

BELT CONVEYOR carried ore from rotary dumper above to stockpile where ore is fed by crane and clamshell to rotary drier at right

sidered transporting the ore by rail, truck, belt conveyor, aerial tram, or pipe line, keeping in mind the rugged topography of the southwest coast fringed by sheer, 500-ft. limestone cliffs. After careful study it was decided that a railroad, although requiring the greatest initial investment, would prove the most economical in the long run. The limestone cliffs, laced with faults caused by earthquakes, offered constant danger of slides, but a wide, stable cut for the railroad was finally achieved after excavation of more than 600,000 cu. yd. of rock. About 425 tons of dynamite were used on the job.

Arriving at Port Kaiser, the gondola cars are emptied into a hopper by a rotary car dumper, whence the ore is fed onto a conveyor belt, the first unit of a 3,100-ft. belt system. The ore is first stockpiled in a 60,000-ton capacity storage area, subsequently to be removed with cranes equipped with clamshell buckets and fed to two 10x80-ft. Hardinge rotary dryers using Bunker C oil as fuel. Dried bauxite is transported by a belt conveyor to a covered storage building 250x160 ft. capable of holding 32,000 tons ready for shipment. Another conveyor reclaims the ore from storage and moves it to a steel and concrete pier extending 995 ft. ➡



PORT KAISER'S ORE HANDLING FACILITIES include storage shed and 995-ft. loading pier.

COVERED CONVEYOR BELT, designed by Kaiser Engineers, reclaims stored bauxite and feeds gantry ship loader.

out from the shore where there is sufficient water depth to handle all sizes of ocean-going vessels. One brought by the conveyor to the pier is loaded automatically into ships by a traveling gantry installation.

Other installations at Port Kaiser include a warehouse, offices, first-aid station, power plant containing five Caterpillar 314-kw diesel generators, machine shop for maintaining all mechanical equipment, and fuel storage tanks. Two new permanent housing projects were also constructed on the island—namely, Spur Tree Camp near Mandeville for the company's American personnel, and Duff House Camp near the mining area for Jamaica workers and their families.

Heading the project for Kaiser Engineers were Don Daly, project engineer; Harry Bernat, project manager; and Burr Tupper, construction manager, all working under the supervision of E. T. Larsen, manager of Kaiser Engineers' General Engineering Division, and George Havas, vice president and general manager. About 1,650 men were employed at the peak of construction. Actual work on the project was started about a year ago.

Transistors— New Use For Antimony?

In research sponsored by Bradley Mining Co., Battelle Institute finds another semi-conductor like germanium

MORE AND MORE FREQUENTLY in the future, you will hear reference to semi-conductors, the elements which give rise to excited speculation about Dick Tracy wrist-radios and the elimination of the vacuum tube.

Germanium started all the discussion a year or so ago, but as research progresses, other elements or alloys turn out to have quite as interesting properties as germanium.

For example, a new semi-conductor in the form of an alloy of aluminum and antimony was developed recently in research carried on at Battelle Memorial Institute, Columbus, Ohio.

Sponsored by the Bradley Mining Co. of San Francisco, the research program indicates a possibility that the aluminum-antimony combination might serve as a substitute for germanium or silcon in transistors or rectifiers.

If this proves to be true, it still does not point the way to a large-tonnage use of antimony. It does, however, indicate that if one is sincerely interested in expanding the usefulness of a metal, as is the management of the Bradley Mining Co., a means can and will be found.

Semi-conductors are unusual in that they combine the properties of an electrical conductor, like copper, and an insulator, like glass. By varying amounts of certain kinds of impurities added to the pure element, great changes in the properties of the alloy can be produced.

For example, the original junction transistor made of germanium, which is the one that seems likely to replace the vacuum tube, consists of a sort of sandwich of layers of germanium crystals having different properties.

Both types of crystals are essentially pure germanium containing small, carefully regulated amounts of other elements. The P-type (for positive) is deficient in electrons, usually because of additions of elements such as boron, aluminum, gallium, or indium. The N-type (for negative) has an excess of electrons because of added amounts of nitrogen, phosphorus, antimony, or arsenic.

A layer of P-type germanium crystals between two layers of N-type, called the N-P-N transistor, or the reverse, called the P-N-P transistor, make up the unit that can replace amplifier tubes. The center layer is the control layer, analogous to the grid of the vacuum tube. A typical transistor is about $\frac{3}{16}$-in. in diameter and contains about 0.002 lb. of germanium.

Similar units can be used to rectify alternating current, and it is possible that small transistors can be made to furnish very large power outputs.

The virtues of the transistor are, of course, small size, low power requirement, long life, as compared with vacuum tubes, reliability, and resistance to shock.

These natural, built-in mechanisms for converting alternating current into direct, and for detecting, transmitting, and amplifying radio signals, have led to the belief that transistors will at least partially replace the vacuum tube in radio, television, hearing aids, and other low-power applications. Transistors may also make possible such developments as portable television receivers and long distance telephone dialing, where the greater size of the vacuum tube has been a limitation.

One stumbling block has appeared recently in the use of a transistor in a hearing aid. In one particular model it developed that high humidity, encountered in wearing the device close to the body, caused failure of the instrument.

Battelle's Work

The research program at Battelle on aluminum-antimony transistors has shown that some of the intermetallic compounds of aluminum, gallium, and indium with arsenic and antimony may become competitors with germanium and silicon in the transistor and the diode field. The investigations, sponsored by Bradley Mining Co., are conducted by Messrs. A. E. Middleton, R. K. Willardson, A. C. Beer and H. Goering.

The following comment comes directly from Dr. Middleton:

"Aluminum-antimony has essentially the same crystal structure as diamond, silicon, and germanium, except that its lattice contains two kinds of atoms. As with germanium and silicon, both P- and N-types of aluminum-antimony can be produced. The room-temperature electrical resistivity of aluminum-antimony has been varied by a factor of more than 500,000 through controlled processing of the material.

"The variation of electrical resistivity with temperature for aluminum-antimony specimens of various resistivities in the range of from 0.01 ohm-cm to 500 ohm-cm resembles that for silicon with various concentrations of boron impurities. However, the intrinsic energy gap of aluminum-antimony is somewhat larger than that for silicon.

"This suggests that it may have advantages over germanium, and perhaps silicon, for high-temperature electrical device applications of interest to the military.

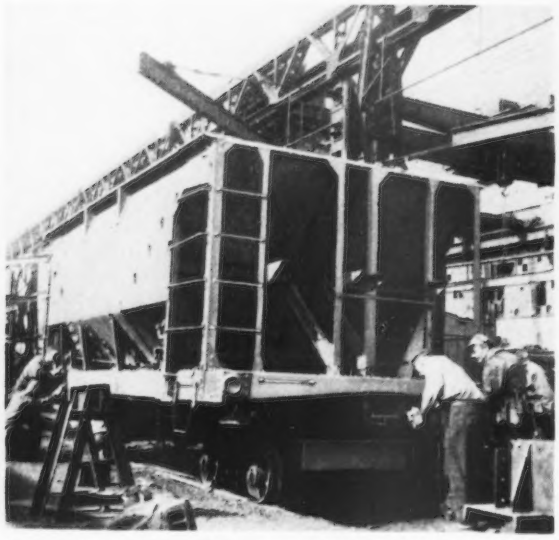
"An additional advantage lies in the price of aluminum-antimony. Each of its constituent materials costs less than 50¢. per lb. Thus 1,000 lb. of aluminum-antimony would cost approximately the same as a pound of germanium.

"Both P- and N-type diode rectifiers have been made with aluminum-antimony. Rectification ratios close to 10,000 have been achieved with this material in contact with several different types of metal point contacts. Furthermore, this work has shown that aluminum-antimony can act as an electrical switch under exposure to light and can be used to convert light into electrical energy."

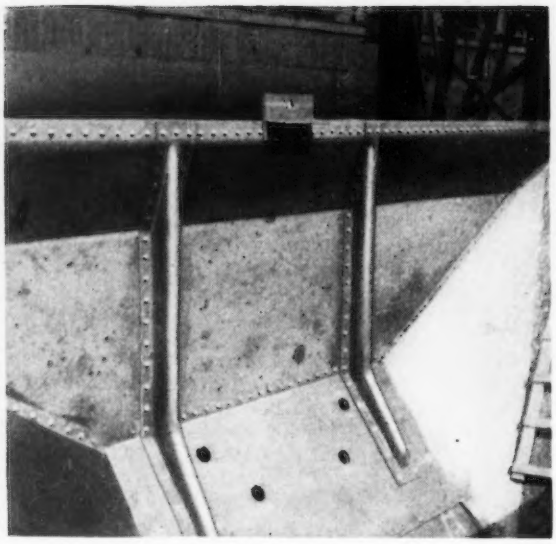
This project has aroused great interest, pointing up, as it does, the great possibilities for new discoveries in the field of solid-state physics. Despite the difficulty of comprehending much of what a research man in electronics has to say in his technical papers, it is apparent to anyone that in the fields of automatic control, high-speed computers, light-sensitive devices, television for industrial use, and others, the metallurgical industries have a leading role to play.

The Bradleys are to be commended for supporting research in what is one of the newest and most fascinating areas of scientific and industrial progress.

KEEPING TAB ON PRACTICE



NEARING COMPLETION is this 70-ton ore car being built for Bessemer & Lake Erie Railroad by Greenville Steel Car Co. An order for 500 was recently completed. The car has new features to facilitate handling iron ore.



POKE HOLES in slope sheet of new ore car permit insertion of steam jets when thawing is required. Frozen ore retards unloading. Seventy cars can be thawed every three hours in cuts of 35 cars each on parallel tracks.

New Ore Car Has Features Designed To Facilitate Loading, Dumping, Thawing

REFINEMENTS MADE IN DESIGN and construction of a new type of ore car recently placed in service by Bessemer & Lake Erie Railroad assure the following advantages over conventional 70-ton and 90-ton hopper cars:

1. Nearly 50% saving is made in yard track space.

2. Bottom unloading through a trestle is possible.

3. Car is easily handled in a dumper.

4. Ore thawing is facilitated.

Greenville Steel Car Co., subsidiary of Pittsburgh Forgings Co., has built 500 of these 70-ton capacity all-steel ore cars for the railroad company. Basically, the cars follow the design of the Duluth, Missabe & Iron Range standard ore car used in short-route service. They are now engaged in mainline long-haul transport of iron ore and limestone.

One of the features of the new car is the bottom door opening. Doors are hinged at the side sill to open outward and downward, so as to place the lading directly between rails. Apron plates prevent the ore from spilling over the end of the doors. These hopper doors clear the rail when open, and close together at the center line of the car.

The door mechanism is operated with a 4-to-1 ratio. A pinion in the gear allows one man to open or close the doors safely from either side of the car. Safety is assured by clutch collars that form a "lost motion" device, so that the operator creates his own safety factor before tripping the load.

Bottom or floor sheets are constructed to provide a 50-deg. slope, 20 deg. steeper than the floors of ordinary hopper cars. This assures that the lading will flow out when the doors ore opened. How fast it will flow depends on the weather and the wet or dry condition of the ore. In freezing weather, pipes are inserted into the frozen ore through holes in the slope sheets and live steam is turned into the frozen mass to thaw it.

The top side construction of the cars was designed to provide the same height above rail (10 ft. 8 in.) as that of other cars of the railroad. This has helped in handling them in car dumpers by providing a good surface for the clamps and strengthening the cars against shakeout damage. The car's outside width is 10 ft. 6 in.

Each new car is only 27 ft. 2 in. when coupled, so a train of 100 such cars will occupy only 2,717 ft. of track space, as contrasted to 4,417 ft. for a train of 100 all-purpose 70-ton hoppers. The short-coupled car is an advantage, especially in mill yards where track space is limited.

The car has 1,096 cu. ft. capacity, level full. This is 96 cu. ft. more, or 6 to 7 additional net tons per trip, over the rating of the D.,M. & I.R. cars mentioned.

Nominal capacity of the car in pounds is 140,000. The load limit is 166,000 lb.

The cars have Westinghouse automatic empty and load air brakes with load compensating cylinders and automatic brake slack adjusters. Bottom-operated couplers and rotary uncoupling levers suspended below the end sills are also used.

More of these cars have been ordered by the railroad, for delivery this August.

Diamond Drill on Airleg

FOR SHORT TEST HOLES in the back floor and walls of stopes in an irregular replacement orebody in limestone, a diamond drill has been mounted on an airleg like that used with percussion drills.

The motor is of the vane type and is made by T. Connors Diamond Drilling Co., of Vancouver, B.C. It weighs about 30 lb. and the leg about 25 lb.

The drill rod is $1\frac{3}{16}$ in. in diameter. It is used in 2 ft. 6 in. lengths with a 2 ft. 6 in. core barrel and a standard bit.

The complete unit is easily trans-

THIS SHOVEL has been developed for jobs where overhead clearance is not of moment but where large rocks and materials must be handled that will not dump readily through conventional bucket.

Front-Dump Shovel Handy for Big Pieces

EAGLE PICHER MINING & SMELTING Co., Cardin, Okla., is testing one of the new front-dump shovels built by "Quick-Way" Truck Shovel Co., Denver, Colo. (See Survey of Mining Practice, *E&MJ*, Feb., 1953, p. 117). This shovel will handle large rocks and materials that will not dump through a conventional shovel bucket.

Basically, this unit was designed for underground work in mines where low overhead clearances and maximum dumping heights are required. It is a full-revolving, modified Quick-Way Model "L" powered by a diesel engine with exhaust scrubbers for underground work, and mounted on a diesel-powered M-52 half-track with exhaust scrubbers. A cab is optional.

The front-dump, ⅝-cu. yd. shovel attachment is cable-controlled throughout and equipped with positive automatic cable crowd utilizing rack and pinion on twin dipper sticks. A similar attachment can be had for mounting on any standard Model "L" unit for quarries and other places where overhead clearances are not involved but where moving large rocks and volumes of materials is a problem.

Eagle-Picher is loading 3 to 4 tons of lead-zinc ore per minute into trucks 7½ ft. high, according to the manufacturer.

AIRLEG MOUNTING of diamond drill has reduced setting-up time underground to practically nothing.

ported to any place in a mine. Setting up time is nothing. Low-angle holes in the walls and up-holes in the back are drilled with the machine mounted on the leg. Vertical down holes can be drilled using the drill as a plugger.

Holes up to 40 ft. in length have been drilled. Between 40 and 50 ft. of hole can be drilled in one shift.

Once the hole is collared, drilling speed is comparable to that obtained with a conventional drill.

With low-angle holes some difficulty is experienced in keeping enough pressure on the bit. The machine was not very successful in hard rock, such as granite, for this reason.

Q. G. Whishaw, senior geologist, Canadian Exploration Ltd., Salmo, B.C., sends this information.

Practice Glimpses

NONE OF THE CARBIDE-INSERT detachable bits tried to date will compete with carbide-tipped integral rods, according to a nickel company in Ontario. The number of airleg-mounted drills it has in service has been increased 30%. In long blasthole work the company is using Canadian-made rods and couplings successfully.

Ground is supported in one of its shafts by concrete rings, 5 ft. deep by about 18 in. thick and spaced 8 ft. c. to c.

Two new hoists have been installed at the company's main shaft. That for the two skips has a 170 by 100-in. double clutched drum, grooved for 1¾-in. rope and powered by two 1250-hp. ac motors, with dynamic braking. The new skips, of 150 cu. ft capacity, have rubber-tired wheels, are built of mild steel. Rope speed is 2200 fpm.

Two 500-hp. motors are used on the cage hoist, handling a double deck cage. Rope speed is 1500 fpm. Otherwise the hoist is the same as the skip hoist.

Treatment of mill tailings by a Dorr Clone to get sands for backfilling stopes is being investigated.

●

Another Ontario operator, Paymaster Consolidated, Charles E. Cook, general manager, has adopted Canadian Copco drills and Coromant carbide-tipped steel in shaft sinking with good results. About 800 ft. is drilled per steel.

●

Decreased bit cost and greater drilling speed have been secured by changing over 100% from multiple-use steel bits to detachable carbide bits at a base-metal mine in New York State.

Adoption of carbide bits and coupled rods in long-hole drilling has given the same operator excellent results in the course of breaking about 11,600 tons, with more tons per drill man shift and much improved fragmentation. Best spacing of holes and size of powder have not yet been determined. Bit size is 2-2¼ in., the drill 3½ in.

Roof bolting is being used cautiously here, to the extent of about 100 bolts per month.

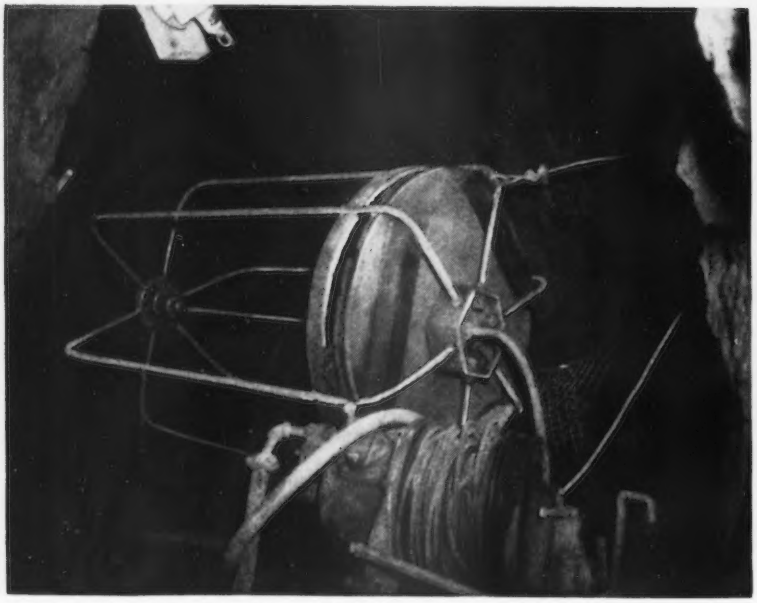
A Goodman Mancha 3-ton diesel locomotive is hauling trains of ten 2.5-ton cars between two shafts through main haulageway having excellent ventilation (7,500 to 19,000 cfm.). Haulage distance is one mile.

●

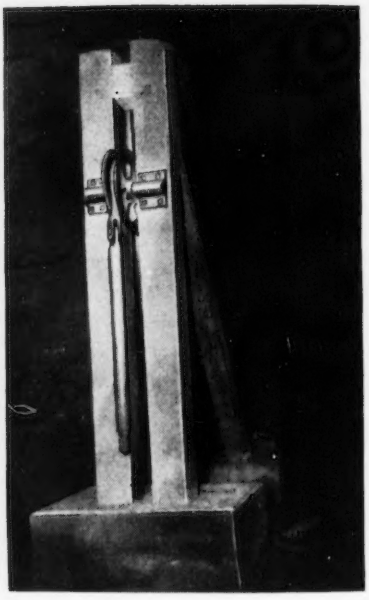
Park-Utah Consolidated, Park City, Utah, has found that single-use bits do not stand up in hard ground but make a good combination with detachable carbide bits when supplemented with them. They find also that airleg-mounted jackhammers offer advantages in many places.

Impregnated timber in the main haulageways at this mine, after 20 years in place shows no deterioration. In the past two or three years the company has been trying soaking the timber in tanks.

(*Continued on page 102*)



BIRD-CAGE PLATFORM, used in driving 100-ft. raise, after it has been pulled from bottom of opening by tugger hoist. Top is protected by heavy wire.



STEEL BAR connects cage and rope. It is also used to clean out drill hole.

New Raising Technique Developed Experimentally

TECHNIQUES DEVELOPED BY Tennessee Copper Co., in driving a 100-ft. vertical raise at its Central shaft will be used in driving a 460-ft. raise at the north end of its Boyd mine at Ducktown. Results were favorable. Lower cost and safer operation than could be had by conventional methods are expected.

The 100-ft. raise will connect the 10th level to the ore pass going to the crusher at the 14th level. This is part of the development project under way to handle at Central shaft all Boyd ore and eventually all ore from the company's Calloway and Mary mines.

The project was considered a performance study to develop a technique for the larger job ahead, and no effort was made to establish any work records.

The raise, already completed at Central shaft, is 6 ft. in diameter. The shaft in Boyd mine will be 6 ft. in diameter and then enlarged to 13 ft. It will be an extension of Boyd shaft which is used for handling personnel and supplies.

In driving the 100-ft. raise a 4-in. hole was diamond-drilled to carry the hoist rope for handling the 1000-lb. cage, which was used as a drilling platform. A 40-hp. single-drum hoist, with ¾-in. wire rope, was set up at the 10th level for the work.

The cage was constructed of 1¼-in. round steel rods, the six rods giving a bird-cage effect. It is 5 ft. in diameter and 7 ft. long, with a wood floor on a steel plate. A wire screen over the top provides overhead protection. There is a center rod in the cage for the men to hold onto when the cage is moving.

The round steel bar connecting the cage and hoisting rope is 3 in. in diameter and 5 ft. long. It is used to clean out the hole in case of slight stoppage after blasting.

When getting ready for drilling the cage was blocked in position with 6-in. (or 8-in.) by 2 ft. timber wedges to prevent swaying during the cycle. A tugger hoist was installed at the foot of the raise to pull the cage out of the way after it was taken off the rope before blasting. This was quick and simple.

Technique

In driving the raise the work was confined to one shift per day. A cycle was easily completed in that time.

At the start of the shift, the crew raised the cage to the face, inspected for missed holes and cleaned down all loose ground. On the next trip the drilling equipment was taken to the face.

With the cage hoisted and blocked in position, a total of 23 holes was drilled 7 ft. deep into the rock, a siliceous graywacke. About 60 lb. of dynamite was loaded per heading. The cage was then lowered to the bottom and pulled out on the level by the tugger.

Using the 4-in. center hole no difficulty was had in breaking the round.

When working one shift the advance averaged about 6 ft. per day. Three men were required, including one hoist operator and two drillers.

The drill employed was a 90-lb. stoper using 1-in. hex. steel and a 1⅝ in. carbide bit.

Communication was maintained between cage and hoistman by electric bell signals.

When extended from the 10th to the 14th level, the present man shaft in Boyd will provide access to the lower haulage level.

In the first phase of the work at Boyd, a 6-ft. diameter raise will be driven the entire 400 ft. After this is completed, the present elevator cage, now in operation down to the 10th level, will serve as the master cage and there will be a smaller cage attached underneath for workmen to use in enlarging the new shaft from 6 ft. to 13 ft.

As the work of enlarging progresses downward, the cage guides will be installed with other steel work. In this manner it is expected that the new work will not interfere with other mine operations.

Heavier Steel, More Air Ejecting Cuttings

TWO-INCH-ROUND CRUSCA HOLLOW DRILL steel with a ¾-in. diameter hole is being used with Joy's new Challenger drill (see "Keeping Tab on Practice," *E&MJ*, March, 1953, p. 101). This steel is made by Crucible Steel Co. of America. It weighs 10 lb. per ft. Its ¾-in. hole has twice the diameter of the $^{11}/_{32}$-in. hole of Crusca 1¼-in. round steel and therefore four times the cross-sectional area of the latter. Thus the heavier steel permits four times the volume of air to be used in blowing cuttings than the 1¼-in. steel would allow.

DEPRECIATION

And Its Crucial Economic Role

The sixth annual McGraw-Hill survey of Business' Plans for New Plants and Equipment, just completed, reveals some remarkable facts about the role of depreciation in our economy. To most people, depreciation is a technical term, used by accountants to discuss a dull subject. But it really is a simple matter: It is the amount of money set aside each year by a company to replace plant and equipment that is wearing out. And here are some facts from this survey* which show how depreciation can make the difference between prosperity and recession in the United States:

1. *In 1953, about half of all the money spent on new manufacturing plants and equipment will come from depreciation reserves.* For the future, manufacturing companies are relying even more heavily on this source of money. In the years 1954-56, they count on using their depreciation funds to pay for almost two-thirds of the new plants and equipment now planned.

2. *The amounts of money made available by depreciation allowances vary greatly from industry to industry.* Some industries, such as those producing steel, chemicals and petroleum products, will have relatively large amounts of cash available from their depreciation reserves. In considerable measure, this is because the government is allowing them to accumulate such reserves at an accelerated rate as an encouragement to build facilities required for national defense. But most of the companies engaged in the production of textiles, processed foods and many kinds of machinery have had little chance to benefit by this provision for accelerated depreciation. Hence, they have much less money available from depreciation reserves.

3. *There is a definite shortage of investment funds in the industries that have relatively low depreciation allowances.* Taken together, the coal mining, textile, food processing, machinery and other metal-fabricating industries plan to spend about $4.7 billion for new plant and equipment this year. But they report that they would spend $1.5 billion *more* per year during the period 1954-56 if sufficient funds were available.

4. *Eighty-five per cent of the manufacturing companies covered by the survey reported that they plan to invest all their depreciation funds* to keep equipment up-to-date and to provide capacity for new products and new markets. These companies could let their depreciation funds pile up as idle cash. But the intention is to spend most of them for capital equipment.

*The sixth annual McGraw-Hill survey of Business' Plans for New Plants and Equipment included companies that provide 25 per cent of all industrial employment and 60 per cent of employment in those industries where capital investment is highest. These companies are mostly the larger companies in their respective industries. A copy of the full report of this survey can be obtained by addressing: Department of Economics, McGraw-Hill Publishing Company, Inc., 330 West 42nd St., New York 36, N. Y.

Hence, there is a direct relationship between the amount of depreciation funds available and the level of capital investment. And it is upon the latter that the level of general prosperity decisively depends. One-third of all industrial workers are engaged in producing or installing such equipment.

This fact that the level of depreciation allowances has a major bearing on the level of capital investment should not surprise anyone. In several foreign countries where these allowances have been increased, investment has boomed. The two nations with the highest ratios of investment to national income are Canada and Norway. Both countries adopted flexible depreciation policies after World War II. In Sweden and The Netherlands also, flexible depreciation allowances have contributed to rapid industrial expansion. Finally, the tremendous investment brought about by our own rapid amortization program shows dramatically the importance of depreciation in stimulating capital expenditures.

Obsolete Tax Laws

In spite of this record, the fact remains that our laws and the business procedures that govern depreciation allowances—in particular the laws and rulings that govern the deduction of depreciation from taxable corporate income—are still based on antique and obsolete accounting concepts which take no account of depreciation's dynamic role in our economy. The internal revenue code still requires most companies to depreciate their equipment over a long period, even though these small annual allowances cannot possibly pay for the investment that is necessary to keep a plant up-to-date under today's rapidly changing technology, with its production of new and improved machinery.

The only allowance made by the government for rapid depreciation is that which is authorized for certain types of plants during the defense emergency. Under this policy most companies are unable to use accelerated depreciation for tax purposes. And as defense projects are completed, the number of new authorizations is dropping. We may lose the chance to utilize fully this powerful tool for sustaining investment because, under our ramshackle emergency tax structure, accelerated depreciation is available only to a minority of firms on a temporary basis.

New Policy Needed

A sensible, up-to-date depreciation policy for tax purposes is long overdue. Either the Treasury must modernize the internal revenue code on its own initiative, or Congress must take the lead by writing into permanent law a flexible depreciation policy applicable to all companies.

Treasury experts now have before them a number of proposals to allow faster depreciation for the average firm. The U.S. Chamber of Commerce has suggested that companies be allowed to deduct from taxable income 25 per cent of the cost of new equipment in the first year, with the remaining cost to be deductible over the life of the facilities. The Machinery and Allied Products Institute has long sponsored a formula that would allow full deduction in two-thirds of the estimated life of the property. In Congress, Chairman Reed of the Joint Committee on Internal Revenue Taxation has stated that we need a more flexible depreciation policy. Senator Frear of Delaware has introduced a bill that would let a business make its own choice on how fast to depreciate its equipment.

It will take time and study to determine which of these various proposals best fits the needs of the economy without sacrificing unduly the revenue needs of the government. If we are to have a new depreciation policy, designed for a long period ahead, it must be carefully worked out. But this much is clear right now: *The development of a flexible depreciation policy on the part of the federal tax authorities is one of the most important steps that can be taken to sustain prosperity. When we talk about depreciation, we are talking about the money that pays for almost two-thirds of the new manufacturing facilities now scheduled for construction. We are talking about the new investment and the new jobs on which our continued prosperity depends.*

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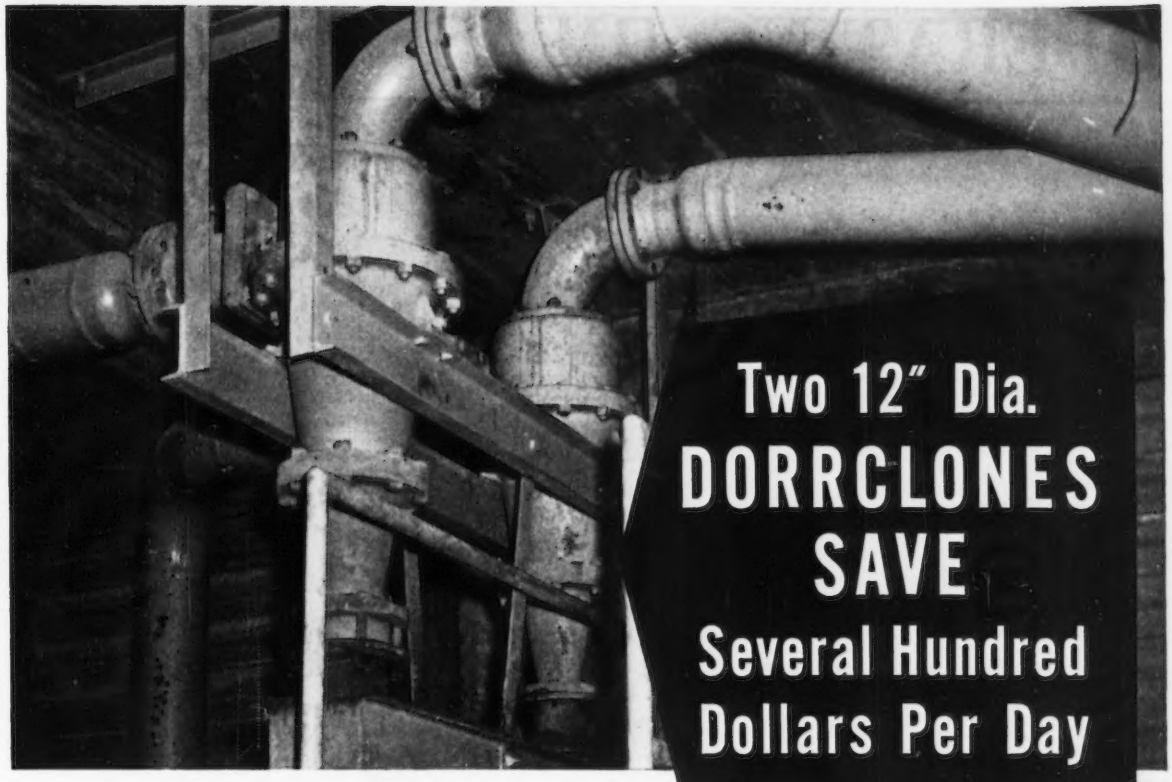

Two 12″ Dia. DORRCLONES SAVE Several Hundred Dollars Per Day

On Raw Clay For Cement Manufacturer . . .

Problem: A Southeastern cement manufacturer needed clay of a certain composition for his mix. A local deposit was available but silica content ran too high for direct use. Alternatives were — bring in clay of a suitable grade from a distance . . . or find an economical way to up-grade the local material.

Solution: Two 12″ dia. DorrClones were installed to classify the raw clay slip prepared from the local deposit. Required grades for the mix are produced at savings averaging several hundred dollars per day on raw clay costs.

Here's another case where the unique classification features of the DorrClone have paid off in a wet processing flowsheet. At this plant, three types of cement are produced . . . each requiring a specific grade of clay in the raw mix. Two 12″ dia. DorrClones degrit high silicon content clay from a local deposit to supply all three grades. Equally important, silica is reduced to the desired amount in each grade simply by varying the feed pressure to the units. No additional dilution is necessary and the excess silica is removed as a low moisture underflow product.

If you have a desliming or degritting problem, there's a good chance that the DorrClone, with its high-capacity-for-size and ability to handle flocculent or heavy pulps, will be the solution. If you'd like further information on this flexible new unit, write for Bulletin No. 2500 to The Dorr Company, Stamford, Conn.

DorrClone is a trademark of The Dorr Company, Reg. U.S. Pat. Off.

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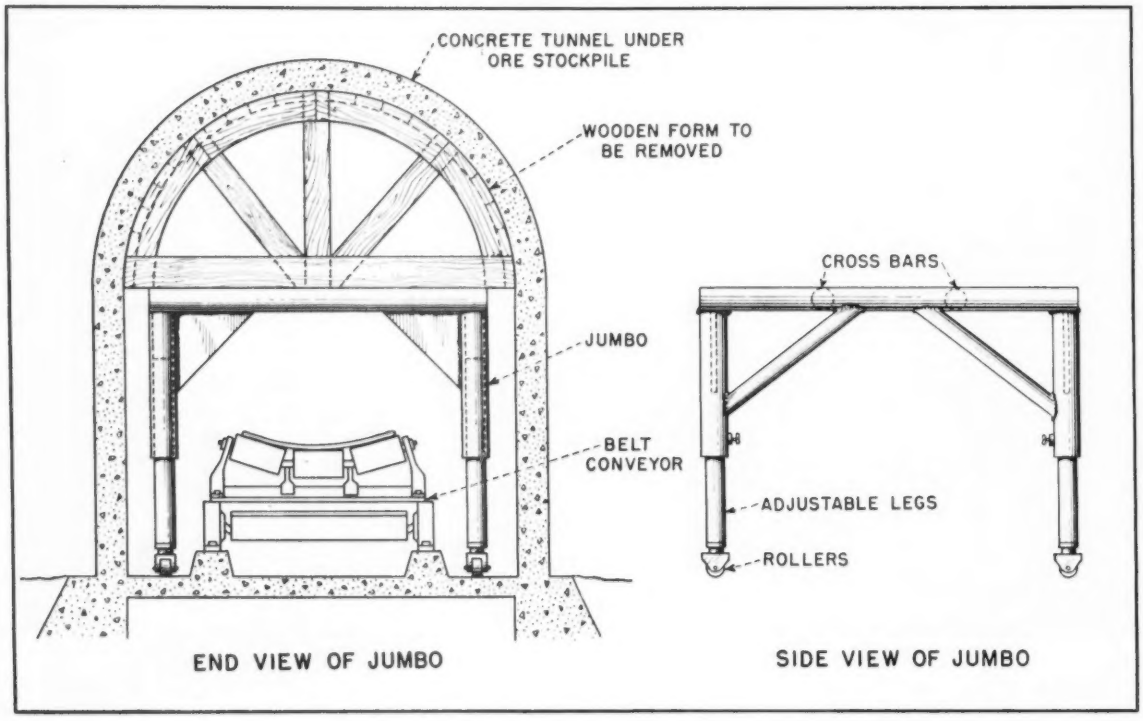
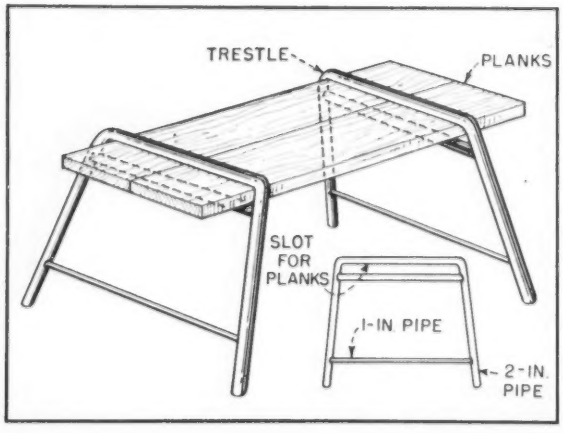


Jumbo Removes Forms in Concrete Tunnels

KAISER ENGINEERS, designers and builders of the large beneficiation plant now nearing completion at Kaiser Steel Corp.'s Eagle Mountain iron mine in Riverside County, Calif., devised this simple portable steel jumbo to remove the wooden semicircular forms from completed tunnel sections running under ore stock and surge piles. It has also been found very useful in mounting the discharge gates to the roofs of the tunnels, especially in those already containing a belt conveyor installation. Simple in design, the table-like jumbo can be made at low cost at the mine machine shop from scrap pipe, the only parts to be purchased being the rollers for the four legs. The pipe frame and bracing between legs are all welded, and raising and lowering the jumbo top requires but a quick adjustment of the telescopic legs. Fitted with sturdy rollers, the jumbo can be moved into and out of the tunnel with little effort. Fred Wright, superintendent, Kaiser Engineers, directs construction work at the Eagle Mountain iron mine.



Light-Weight Combination Work Bench-Platform

THE SIMPLE AND PORTABLE PLATFORM assembly above has been found useful at several mining properties in the West both as a work bench in the machine and repair shops and as a platform underground when doing trolley wire repair work, placing rock bolts, timbering etc. Essentially it consists of two trapezoidal trestles made from 2-in. pipe with bracing and a cross bar welded between the legs near the top to form a slot, and short lengths of wooden planks. Assembly and dismantling of these parts is a matter of seconds. The planks are simply inserted into the slot of each trestle and removed when the platform or bench is to be moved to another location.

INDUSTRY'S ALL-TIME FAVORITE FOR LONG RANGE *Economy*

JENKINS
Fig. 106-A
Renewable Composition Disc

BRONZE GLOBE VALVE

150 lbs. Steam
200 lbs. O.W.G.

Take a Jenkins Fig. 106-A apart. It's easy to see why it is industry's all-time favorite. Note the liberal dimensions of body and bonnet casting — the heavy, manganese bronze spindle, with more strong threads in contact with the bonnet, regardless of spindle position. See how the slip-on, stay-on disc holder fully protects the edge of the disc, prevents creeping, flaking, or cracking.

Every part, from perfect grip, heatproof handwheel to pipe ends, reflects the designing skill of Jenkins valve *specialists.* There's a good reason. Jenkins Bros. introduced the *first* renewable composition disc valve, — is today the only manufacturer of both valves *and* discs.

Fig. 106-A not only looks better — it proves out better in performance. In any comparison, its long life, low upkeep record has never been surpassed. That is the true measure of valve cost — and it is the reason why industry's shrewdest buyers will settle for nothing less than Fig. 106-A quality.

JENKINS VALVES

LOOK FOR THE DIAMOND MARK

SINCE 1864 TRADE JENKINS MARK

Jenkins Bros

GET THIS FOLDER — Gives details of Fig. 106-A design, and "family" interchangeability. Ask your Jenkins Distributor for Form 189-A, or write Jenkins Bros., 100 Park Ave., New York 17.

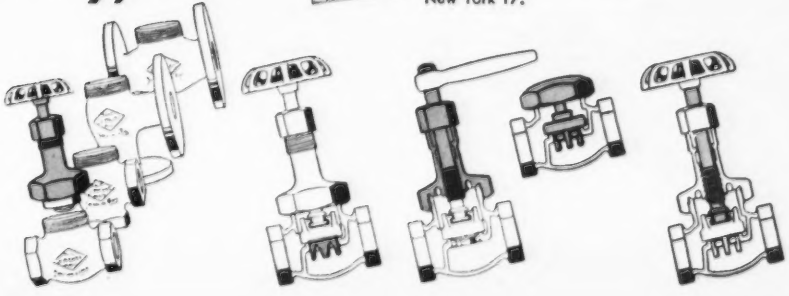


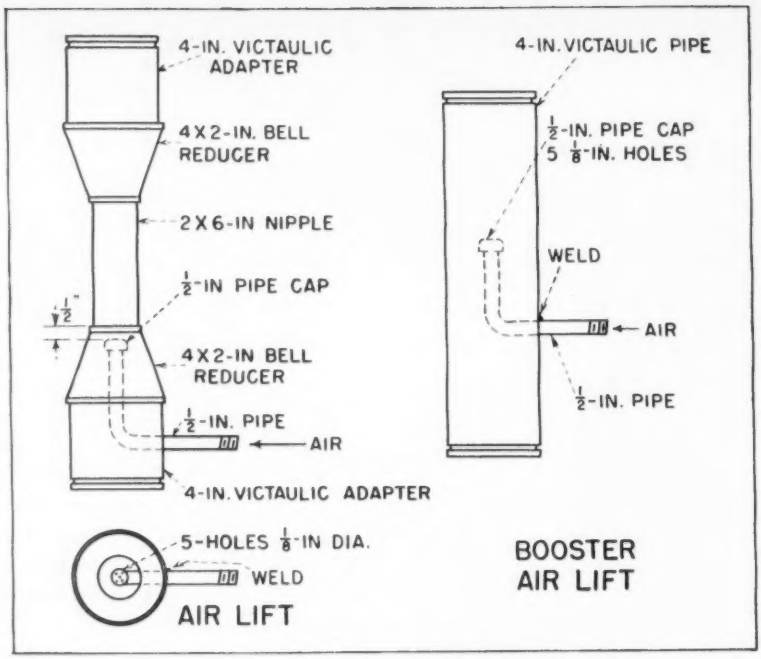
Fig. 106-A "Family" Interchangeability meets 90% of your valve needs with a small inventory of parts. Start with the standard Fig. 106-A. Trimming is interchangeable in Globe or Angle body, screwed or flanged. With a few parts, quickly-assembled combinations provide a Lift Check, a Spring-loaded Check, and valves for Stop and Check, Quick-opening, or Throttling service.

Effective Air Lift For Mine Shafts

P. S. CROSS, mine superintendent of Renabie Mines, Ltd., Ontario, describes the following successful use of air lifts in the Renabie property.

The shaft was allowed to flood from a point 50 ft. below the 1400 level to the 1100 level while an old sump was being removed from the 925 level station, and a new one established. An air lift, designed as shown here, was installed 10 ft. below the 1400 station in an existing 4-in. line in the shaft. This line discharged into a sump on the 375 level. A booster air lift was installed in the same line at the 1100 station. Air for both lifts was regulated through a large gate valve installed in the main 6-in. air line in the shaft extending down to the 1400 level. This combination of air lifts lowered the water level to a point 100 ft. below the 1100 level and handled the mine drainage as well. A total lift of 875 ft. above water level was obtained with a submergence of only 160 ft., or 15.6% of the entire column. Flow of water was about 15 gpm.

The same combination was later used to unwater the shaft to a point below the 1200 horizon. This water discharged into the 925 level. The water was then lowered to a point 25 ft. below the 1400 station, the air lift being 10 ft. below the level. In this installation a lift of 450 ft. was obtained with a booster lift on the 1100 level. Submergence was only 35 ft., or 7.8%. Volume of water moved was 10 gpm. Air pressure in both cases was 85 psi.



The air lift at the bottom of the shaft consisted of two 4x2-in. bell reducers joined by a 2x6-in. nipple. Four-inch Victaulic adapters were attached to top and bottom. A ½-in. pipe was passed through the lower adapter and turned up inside, with the top of the pipe coming to a point ½-in. below the 2-in. nipple. A cap was placed over this pipe and five ⅛-in. holes were drilled through the cap in a square pattern.

Best performance was obtained when the diameter of the reduced section was one-half the diameter of the pipe line. Very little air is required, and this should be adjusted so that the water flows from the end in a steady stream.

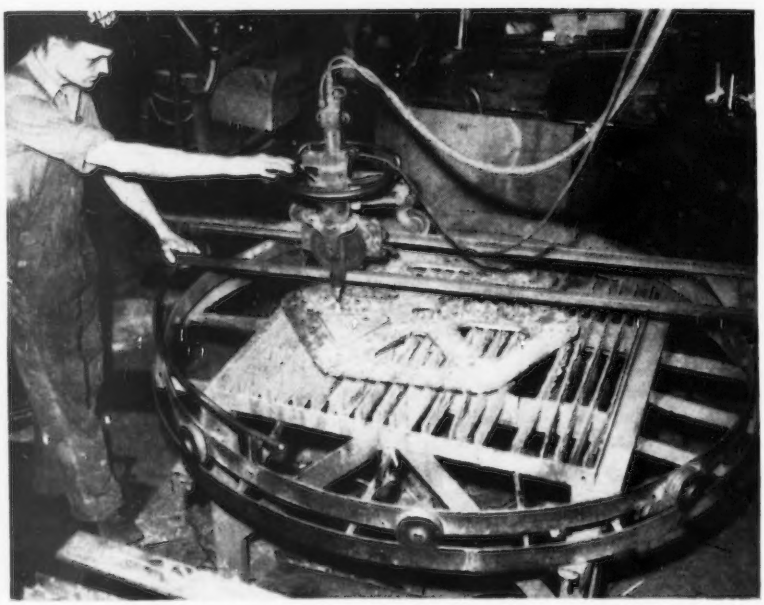
Any number of boosters can be installed in the line. The booster air lift consists of a short piece of 4-in. Victaulic grooved pipe about 2 ft. long with a ½-in. pipe passed through and turned up. This pipe also has a cap on top with five holes ⅛-in. in diameter.

Handy Cutting Jig

THIS CIRCULAR CUTTING jig is used to cut intricate straight-line patterns from steel plate. An Oxweld C_2-16 cutting machine is mounted in the jig which can be moved manually through 360 deg. to follow any straight-line pattern.

A sturdy angle-iron table is the base for the jig. A circular steel band, about 5 ft. in dia. is bolted to the top of this base. A second steel band rides on the first by means of a series of rollers. A round bar railing is attached to the second band for a third of its circumference.

The jig can be moved about without moving the part being cut. For further flexibility, the track on which the cutting machine rides is fixed to a swivel joint at one end, and the operator can slide the other end of the track along the railing beneath his left hand.



Make 8 equal 25 —and pocket the difference

To haul more than 800 tons of gypsum rock daily, once took 25 gallons of gasoline a day. Today it takes only 8 gallons of inexpensive Diesel oil!

National Gypsum Co., owner of the mine near Sun City, Kan., made only one change. It bought a Caterpillar D315 Diesel to replace the gasoline engine on its Plymouth locomotive. Fuel costs today are reckoned in *fractions of pennies*—less than ⅛ of a cent per ton!

But there are other reasons for the switch to the Cat* Engine. Samuel Shepler, mine superintendent, explains some:

"According to our findings, Caterpillar Engines are the only ones we can use successfully in the mine because of their lack of fumes. That and the fact that they are sturdy and dependable made our choice."

Engines and electric sets, in 12 sizes up to 500 HP and 315 KW, have their long, productive life engineered into them. Translated into dollars that means you save on down time costs.

Add this saving to your low, low fuel costs and the profit margin begins to climb. Standardizing on Cat equipment makes sound business sense.

Your Caterpillar Dealer—who specializes in quick, efficient service—will be glad to show you on-the-job proof of how these dependable power plants can earn for you. You set the date!

CATERPILLAR, Peoria, Illinois.

CATERPILLAR*

*Both Cat and Caterpillar are registered trademarks—®

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YOUR DEALER
WILL DEMONSTRATE**

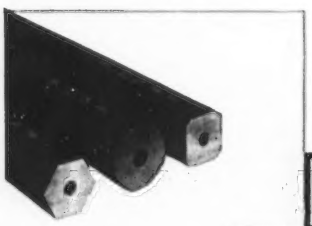
THE MINE FOREMAN

CRUCIBLE HOLLOW DRILL ROD

teamwork in specialties

In the mining industry the foreman is a mighty important guy. He is responsible for the successful performance of mining operations underground—for the supervision of mine workers and for keeping them properly equipped with the tools and supplies needed to get out their round. That's why in so many drilling operations you'll find that the mine foreman prefers Crucible Hollow Drill Rods.

He knows that with rising costs of labor and new equipment he must get the best service he can out of his rock drills . . . with minimum breakage and bit loss. And many a mine foreman has seen first hand that Crucible Hollow Drill Rods do just this . . . that they provide the lowest cost per foot per hole in hard rock drilling. For best drilling performance, use Crucible Hollow Drill Rods.



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first name in special purpose steels

53 *years of* Fine *steelmaking*

HOLLOW DRILL RODS

CRUCIBLE STEEL COMPANY OF AMERICA, GENERAL SALES OFFICES, OLIVER BUILDING, PITTSBURGH, PA.

REX HIGH SPEED • TOOL • REZISTAL STAINLESS • ALLOY • MACHINERY • SPECIAL PURPOSE STEELS

E & M J

NEW PRODUCTS DIGEST

For further information on these products, circle item numbers on card—insert and mail.

Twin Disc Offers Wide Selection of Industrial Drives (1)

FIVE NEW INDUSTRIAL DRIVES, developed to help increase performance, extend civilization, and reduce maintenance of both engine and motor-powered installations used in modern mining and for the production of mining machinery, are announced by the Twin Disc Clutch Co., Racine, Wis.

• Two-Speed Oil-Actuated Transmission was developed specifically for use with three-stage hydraulic torque converters. Designated as the Model T-302, it provides a dual range of torque converter operation. The unit is equipped with a direct drive and single stage planetary gear system. Two ratio spreads are available: direct drive and 2.69:1 reduction, or direct drive and 3.07:1 reduction ratio. The unit is designed for easy installation and simple maintenance.

• Two-Stage Hydraulic Torque Converter is particularly adaptable for heavy-duty engine installations used in mining for extracting, processing and transporting materials. Providing maximum operational efficiency, the two-stage design develops up-to-4:1 torque multiplication at stall, combined with progressively increasing engine speed during acceleration and uniform pull-down under load. Principal feature is the freewheel stator blades, which provide complete unloading of the engine at high-speed, no-load conditions.

Model S offers a standard spider drive input, and is equipped with a built-in converter charging pump around the input shaft. Inlet and outlet connections are provided for piping converter fluid to and from a cooler, which can be an oil-to-water heat exchanger or an oil-to-air radiator.

Two types of output shafts will be available: (1) Straight shaft extension type, mounted on maximum bearing centers; (2) flanged shaft type, to permit use of a "U" joint connection for in-line drives.

Twin Disc has also designed a disconnecting type, called the Model SD (illustrated). Essentially the same as Model S, Model SD incorporates the additional features of (1) quick-release dump valves on the rotating turbine wheel, to permit release of the oil from within the converter circuit, and (2) a 2-position control valve, located on top of the stationary converter housing for actuation of the dump valves.

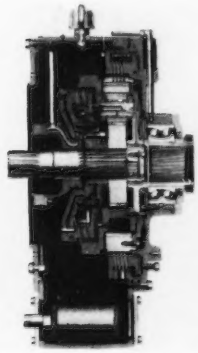
Particularly compact in size, the Model SD's overall length is considerably less than a converter equipped with a conventional friction clutch between converter and engine.

• Air-Actuated Clutch offers mining a remote-controlled friction drive lighter and more narrow than the conventional air-actuated clutch. Compactness permits the Model PO clutch to be installed in less shaft space, with closer shaft-bearing center distances. Air actuation is effected through air-cooled diaphragms.

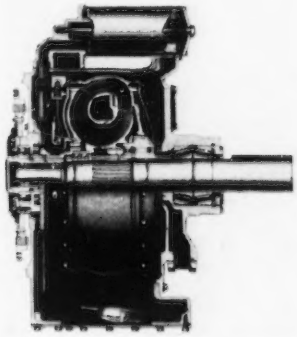
Offered in two and three plate, 24-in. size, there are standard models to fit any job where remote control is desired, and complicated linkage cannot be tolerated.

• Disconnecting Hydraulic Power Take-Off, designed to provide more effective hydraulic linkage for heavy-duty applications requiring quick, positive disconnect of power source from driven equipment, is designated as the Model HUD. Wherever loads have to be lifted, swung, or twisted under conditions involving frequent shocks and high starting torque, Model HUD utilizes peak torque from any type engine, whether gasoline, diesel

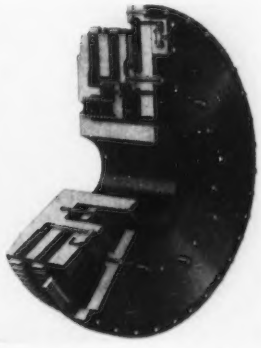
(Continued on page 189)



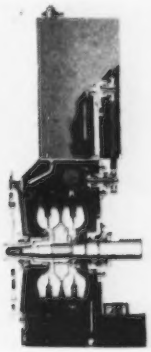
TWO-SPEED Transmission



TWO-STAGE Hydraulic Torque Converter



AIR-ACTUATED Clutch, designated Model PO



DISCONNECTING Hydraulic Power Take-Off

You pick the job!

WHAT's the toughest blading operation you've got? Ditching? Bank-sloping? If you want to see it done better, easier, with more work output per hour, watch a Cat* Motor Grader handle it.

Watch the operator change through the full range of blade positions in one minute without leaving his seat! Get into the seat yourself! Notice how the operator has a full view of his work without standing up. Check the steady production with no stops for adjustment.

Your Caterpillar Dealer is ready to demonstrate any of the three models—No. 212, No. 112, or No. 12. Fair enough? Call him today.

Caterpillar Tractor Co., Peoria, Illinois.

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**NAME THE DATE...
YOUR DEALER
WILL DEMONSTRATE**

For Your Files

This informative manufacturers' literature is free unless otherwise specified. To obtain bulletins circle their numbers on card below and mail.

LIFT TRUCKS. Catalog 54, an eight-page booklet in color, released by Baker-Raulang Co., Cleveland, Ohio describes and illustrates the manufacturer's line of industrial trucks and cranes. (41)

HEATING EQUIPMENT. A buying guide is what this 60-page, two-color bulletin really is. It is the 1953 edition of General Electric's catalog on Calrod electric heaters and heating devices and it describes the equipment in terms of application, special features, installation, pricing. It is indexed by process and application. (42)

AUTOMATIC WELDING MACHINES. A truly automatic packaged welder-positioner for hard-facing, rebuilding crawler tracks, and fabricating, is discussed in a four-page folder from Dean Weld Machine, Inc., Oakland, Calif. (43)

CORROSION RESISTANCE. Here are 48 pages dealing with heat-resistant and corrosion-resistant alloy castings in industry. Tables of composition, charts of engineering data, and over 175 photographs will give plenty of information to users and potential users of stainless and heat-resistant alloys in cast forms. International Nickel Co., New York, N. Y. (44)

DIESEL ENGINE ACCESSORIES. "Attachments For Your Caterpillar Diesel Engine" is a 32-page booklet published especially for anyone considering an engine installation. It contains the most complete selection of attachments ever presented by Caterpillar in booklet form. These attachments are illustrated and described to show you where and how they are used. Caterpillar Tractor Co., Peoria, Ill. (45)

VIBRATION ANALYSIS. This four-page folder from International Research & Development Corp., Columbus, Ohio tells you all about the Vibratron, an instrument for vibration analysis and dynamic balancing. It is used for production, maintenance, inspection, research, detection, and testing of all kinds of machines. (46)

TRANSFORMER BUYER'S GUIDE. The 1953 edition of the G. E. Instrument Transformer Buyer's Guide is now available. The illustrated 102-page publication, GEA-4626F, contains ratings, ASA accuracy classifications, and prices of all G. E. indoor and outdoor potential and current transformers. General Electric Co. of Schenectady, N. Y. (47)

PLACER DREDGES. Yuba Manufacturing Co. has put together a very interesting 40-page brochure on dredges. The booklet photographically covers a wide range of operations, geologically and technically. Dredge men and others too will get a lot of information here. (48)

CONSTRUCTION. Why strain your engineering staff or overload its roster for periodic construction projects? Foley Brothers, Inc., Pleasantville, N. Y., have a 4-page folder that tells you about their completely integrated service that starts with your construction problem and goes through field reconnaissance, analytical reports, field engineering, design and construction. They handle every kind of project—roads, railroads, bridges, tunnels and shafts, concentrators and smelters. (49)

STEEL BUILDINGS. Putting up a new shop? If you are in the market for any kind of new building it will pay you to take a look at this 24-page illustrated catalog from Steelcraft Manufacturing Co., Rossmoyne, Ohio. It contains a wide selection of building styles with construction details. (50)

ROLLER BEARINGS. Catalog No. 28 describes the line of ball thrust bearings, roller thrust bearings and bearings of various other types put out by Gwilliam Co., Brooklyn, N. Y. Numerous drawings and tables offer convenient information. Circle number 51 on the card below. (51)

THREADING TOOL. If your shop has much call to do threading, you should take a look at this bulletin, No. 110D, which completely illustrates a quick and easy-to-use threading tool which does not depend on the skill of the operator for producing a good thread. Rivett Lathe & Grinder, Inc. Boston, Mass. (52)

FEEDER. The Com-Bin feeder is described and illustrated in a four-page bulletin which explains how it can store and feed uniformly any non-free-flowing material like wet filter cake, sludges, or dry solids. Pulva Corp., Perth Amboy, N. J. (53)

SAFETY TREADS. To be sure that any trips your employees take in the future are not over the stairs in your plant, it might be worth-while to take a look at this handy 38-page booklet which illustrates and gives critical details of all kinds of stair treads made by Wooster Products, Inc., Wooster, Ohio. (54)

GAS METERS. A new 16-page booklet on meters for measuring gases of any type and in quantities from 4,000 to 1-million cu. ft., has been published by Roots-Connersville Blower Division

USE THIS CONVENIENT CARD

to obtain further information on products and bulletins mentioned in the New Products Digest. Circle item numbers, tear out and mail.

Not good after August 1, 1953, if mailed in the U. S. or Canada.

Engineering and Mining Journal—June, 1953

NOT GOOD AFTER AUGUST 1, 1953—if mailed in U. S. or Canada.

Please send me the catalogs or further information about the items from New Products Digest whose numbers are circled.

1	8	15	31	38	45	52	59	66	73	80
2	9	16	32	39	46	53	60	67	74	81
3	10	26	33	40	47	54	61	68	75	82
4	11	27	34	41	48	55	62	69	76	83
5	12	28	35	42	49	56	63	70	77	84
6	13	29	36	43	50	57	64	71	78	85
7	14	30	37	44	51	58	65	72	79	86

My Name..... Position.....

Company .....

Address .....

of Dressen Industries, Inc., Connersville, Ind. (55)

BULLDOZERS. "Caterpillar Bulldozer Line," has 36 pages of just that. Plenty of detail specifications of all Cat bulldozers and their attachments. Circle number 56 on card below to get your copy of form 30461 from Caterpillar Tractor Co., Peoria, Ill. (56)

CORRUGATED CONSTRUCTION. There are all sorts of advantages to using Fabco closure strips of asphalt or rubber composition in solving your corrugated building problems. These strips are premolded corrugated caulking for use in sealing the openings formed by the installation of corrugated sheet metal or asbestos against flat surfaces. Fabricated Products Co., West Newton, Pa. (57)

VALVES. Bulletin 1000 describing and illustrating the complete line of valves made by Leedon Manufacturing Co., Los Angeles, Calif. includes operating and circuit diagrams, dimensions and weights. (58)

TRUCK BODY. Eight different uses for one body is how the Maxon Construction Co. talks about their versatile utility body, the Dumpcrete. Four-page booklet tells you all the ways to use it. (59)

ALUMINUM MELTING FURNACES. Lindberg Engineering Co. covers their complete line of Lindberg & Fisher gas and oil-fired aluminum melting furnaces in bulletin 310. The booklet contains photographs, describes uses and lists specifications. (60)

DUMP BODIES. Dump bodies, hydraulic hoists and end-loaders complete with action photographs, engineering diagrams and technical data are covered in catalog L-6512 from Galion Allsteel Body Co., Galion, Ohio. Outstanding feature of the publication is a handy reference table which permits the user to easily select the exact hoist and body best suited to the overall requirements of his job. (61)

SUCTION HOSE. Four types of hose which cover all suction hose service are listed in a new catalog from B. F. Goodrich Co., Akron, Ohio. You will find types of fittings and their recommended uses, material specifications and methods used on construction of the hoses. (62)

RUBBERIZED ABRASIVES. Presenting the adaptability, versatility and application of rubberized abrasives together with complete specifications and prices is the interesting job of catalog number 53 just issued by Cratex Manufacturing Co., San Francisco, Calif. (63)

PUMP. A 1½-in. self-priming centrifugal pump is illustrated and described in bulletins 151 & 152 from the Carver Pump Co., Muscatine, Ia. The pump will handle 6,000 gph at 17 ft. suction lift against 17 ft. total head and will prime in less than 30 seconds with pump 10 ft. above water. Weight is only 55 lb. (64)

TRUCK SCALES. An eight-page, two-color folder, form number 678, illustrates and describes the complete line of modern, heavy-duty Howe four-section, straight-lever, ball-bearing motor trucks scale for weighing big truck and trailer loads. Platform sizes are 45, 50, or 60 ft. long by 10 ft. wide. Howe Scale Co., Rutland, Vt. (65)

TORQUE CONVERTERS. How truck-type three-stage hydraulic-torque-converter drives improve performance, prolong equipment life and prevent operative fatigue in heavy hauling is disclosed in bulletin number 501 published by the Twin Disc Clutch Co., Rockford, Ill. (66)

TROLLEY SYSTEM. Special features of the U. S. Safety Trolley system, applicable wherever current collectors are used as for traveling cranes, bridges, ingot buggies, portable electric tools, etc., are described in a four-page bulletin from Universal Standard, Inc., Pittsburgh, Pennsylvania. The unit can carry loads of 50 to 2,000 a. (67)

PUMPS. For supplying, circulating boosting of water and clear liquids at medium and high heads, with special emphasis on product quality and long life rather than initial low price, Peerless Pump Division, Food Machinery and Chemical Corp., Los Angeles, Calif., has recently completed the modernization and consolidation of a complete line of 2-, 3-, 4-, and 5-stage split-case pumps. Bulletin B-1400 tells you all about Type TU-pumps. (68)

PLATE MAGNET SEPARATORS. Four-page brochure on low-cost permanent non-electric Model C plate magnets, applicable to all but the heaviest tramp iron removal problems, has been issued by the Eriez Manufacturing Co., Erie, Pa. Typical installations of these separators are illustrated with engineering drawings and photographs. (69)

FORK TRUCKS. Comprehensive four-page manual illustrating and describing its entire line of platform and fork trucks and floor cranes is now available from the Elwell-Parker Electric Co., Cleveland, Ohio. Profusely illustrated with lots of detail. (70)

SELF-LOCKING NUTS. If you're having trouble holding things together, you might take a look at a four-page bulletin on self-locking nuts made by Standard Pressed Steel Co., Jenkintown, Pennsylvania. You can also get a bulletin on Hallowell steel shaft collars made by the same company. This 2-for-1 bargain can be obtained by circling number 71 on the card below. (71)

HELICAL GEAR DRIVES. Helical gear drives—their advantages, fields of application and correct selection are discussed in an illustrated 16-page book, No. 2451, released by Link-Belt Co., Chicago, Ill. (72)

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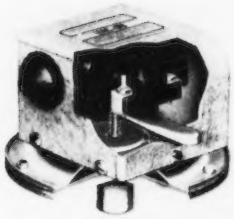
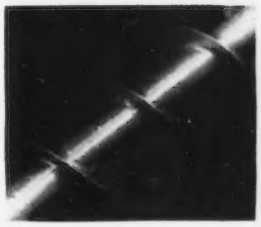
SCINTILLATION COUNTER. A long plateau, excellent reproducibility of results, and a 6-ft. cable conveniently connecting to the G-M output of any conventional scaler, make this instrument handy for a variety of Gamma counting problems. The 2-in. diameter, 7-in. long "SC-2A" is available from Nuclear Research Corp., Philadelphia, Pa. (2)

SPEED REDUCER. Designed for use as a conveyor drive, this unit uses automatic, instantaneous shutoff device for overload protection that eliminates need for sheer-pin coupling. When predetermined load limit is reached, current is cut off by mechanical action. For restarting, remove excessive load. Philadelphia Gear Works, Inc. (3)



SAFETY SWITCH. A vacuum switch that shuts off power source when liquid supply runs dry can be used to shut off any type of power equipment that depends on suction-delivered fuel, lubricant, water, etc. Jaycon Associates, Minneapolis. (4)



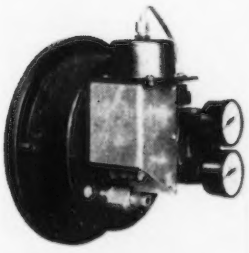
SCREW CONVEYOR. Standard sections of 6-in. diameter stainless steel conveyor are right hand, 6-in. pitch, 9 ft.-10-in. long, ⅛-in. thick and welded to a 2-in. stainless steel pipe adapted for 1½-in. shafts. M-H Standard Co., Jersey City, N. J. (5)

RETRACTABLE LUGS. For efficient operation of rubber-tired tractors in mud, snow, ice and sand, a framework supporting retractable lugs bolts on the outside of the tractor wheel, using same bolts for the tractor wheel and tire. Under bad conditions lug can be extended. Comco, Kilgore, Tex. (6)

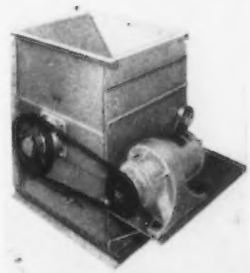
SPARK PLUG PROTECTOR. "Spar-Kover" made by Lucas Products Co., North Canton, Ohio, protects plugs from shorting out. Ceramic cartridge absorbs moisture around plugs. Watertight cover protects from dew, fog, splashing. No tools needed for installation. Available for all spark plugs. (7)

IMPACT WRENCHES. Air-operated impact wrenches can be used for driving bolts, studs or almost any threaded fastener. Model M960 handles ⅝-in. diameter bolts; M970 takes ¾-in. bolts. Weights are 9 lb.-10 oz. and 11 lb. respectively. Both work on 80 to 100 psi. Master Pneumatic Tool Co. (8)

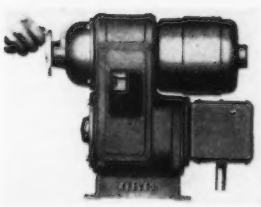
ELECTRICAL CONDUIT. "Sealtite" flexible electrical conduit Type UA is the first of its kind to gain Underwriters' Laboratories approval for use in wet locations. The metal conduit is now available in sizes ⅜ to 1¼ in. and is manufactured by The American Brass Co., Waterbury, Conn. (9)



PNEUMATIC TRANSMITTER. Pressure measurements from vacuum to 10,000 psi. are transmitted by this instrument whose output pressure varies from 3 to 15 psi (or 5 to 25 psi if specified). Full size recording instruments or miniature indicating instruments as far as 1,000 ft. away can be used. Penn Industrial Instrument Corp., Philadelphia, Pa. (10)

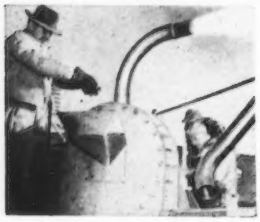


MAGNETIC DRUM. Improvements in permanent magnetic drums made by Eriez Mfg. Co., Erie, Pa., include changeable sheave sizes for various operating speeds; stainless steel shells; dust-tight construction; extended discharge ducts; adjustable feeder assemblies; lightweight, rigid, cast aluminum sides; oil-sealed bearings. (11)



MOTOR DRIVE. Fractional horsepower "Vari-Speed Motordrive" with right angle reducer has speed ratios from 2:1 through 10:1. Handwheel control is standard, but automatic can be applied. Reeves Pulley Co. (12)

ULTRA VIOLET LAMP. "Mineralight M-12" is the only self-contained ultra violet lamp on the market operating on 110 vac. from one 6-v. battery, according to Radiac Co., New York, N. Y. (13)



An avalanche of inquiries about the "Supersonic" rock crusher featured in March, plus a note stating that the story was not accurate in every detail, have kept us busy trying to shed more light on the subject. Here is a further report.

That "Supersonic" Rock Crusher Again!

FIRST WORKING MODEL of a mill in which material swirling at high speed serves as its own pulverizing agent has had more than eight months of successful operation by Cimota Enterprises, Inc., of Boise, Idaho.

This machine, manufactured on special order by Olson Mfg. Co. of Boise, has been used by the company largely for pulverizing minerals used in soil conditioners and fertilizers it produces. However, E. V. Storey, president of Cimota, said he believed the machine could be adapted to grind almost any type of ore.

The machine was purchased by Cimota from Joseph Bassick, one of five which he had constructed. Mr. Bassick was associated with a group of men who own the basic patents on the machine but who felt considerable operational testing and modification were needed before starting full-scale manufacture.

Bassick said, "There now seems sufficient interest in the machine to make it worthwhile to invest additional capital in developing it commercially."

Cimota, however, has been using its unit both commercially and for testing. Storey said they have ground tons of phosphatic shale to 200 mesh with the machine. They have also run tests with harder material such as gold quartz and ordinary river gravel. The machine has pulverized all this material.

"We have used it to process a wide range of material of both hard and soft composition," Storey said. "It has taken rock up to 3 in. and pulverized it into powder ranging to fines as high as 700 mesh."

Unlike conventional ball mills or crushers, the machine does not use any form of external impact in reducing the material. The grinding results from force caused by the rocks whirling against each other under pressure from waves of air moving at high speeds.

Storey said they first crush the material to 2 or 3 in. This is fed into the machine by conveyor belt. A model of the size used by Cimota can handle up to 600 lb. per hr., but Storey said specific gravity of the material being milled makes a difference in the machine's output. Hard materials, such as gold quartz ore, work better in the machine than lighter substances.

In the main cylinder of the machine four rotor blades whirl at 5,000 rpm. They are powered by a 60-hp. gasoline engine. The blades drive out 8,000 cfs, creating a force field which thrusts the spinning material against the case or main cylinder. This force also holds the material away from the rotor blades. Since the material on the outside (closest to the cylinder facing) doesn't move as fast as that close to the rotors, a pulverizing action is set up.

"You might say that the material grinds itself," Storey said. "Figured on a ton basis, we have found the machine will do a cheaper job than possible with other dry-milling machines. It is easy to reline the cylinder, although part of this might be eliminated by use of harder steel. Wearing parts are easily replaced."

As the grinding action goes on, the pulverized material drops into a series of three hoppers. Storey has equipped his machine with classifiers. One collects coarse material for re-milling and the other two can be equipped with screens of varying mesh. Circulating load varies with the type of material. Heavier, harder material seems to pulverize more easily with less need for re-milling.

So far, no means have been devised to obtain selective milling. Operating speed does not give complete control over fineness of milling. Composition of the material largely determines how fine it will be pulverized.

Storey emphasized that the machine was still more or less experimental in nature and he thought it needed modifications to ready it for commercial development. Officers of the company which owns basic patents on the machine agree with Storey in that respect. The company—Minerals Research Corp.—is in the process of reorganization. Officers said that because of recent interest in the machine, following public demonstrations at Reno, Nevada, late in January, they hope to perfect engineering with the aim of starting manufacture as soon as possible.

The machine was invented by O. E. Walling, formerly of Los Angeles, who sold his patent rights to William F. Spain, Bishop, Calif., mining engineer; Troy E. Becker, manager of a mine near Arco, Idaho; Joseph L. Ausich, mine operator at Mackay, Idaho, and A. K. Guard, a geologist and engineer employed by Morrison-Knudsen Co. of Boise, Idaho. They formed Minerals Research Corp. to carry on development. Officers of the corporation are Guard, president and manager; Spain, vice president; Ausich, secretary treasurer; and Joseph Bassick and J. L. Eberle, both of Boise, directors.

Patent is pending on the machine under the name of "molecular separator and material pulverizer." **(14)**

SHAKER CONVEYORS are designed for handling hot, abrasive materials. At Trail, Consolidated Mining & Smelting plans to use these units to transport hot sinter direct from roasting ovens to the mill. Goodman Mfg. Co. **(15)**

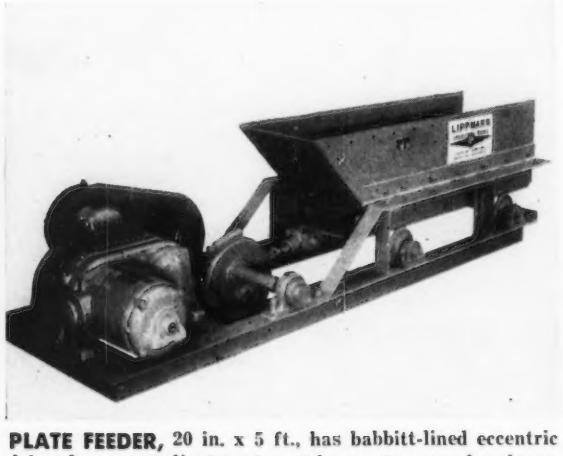
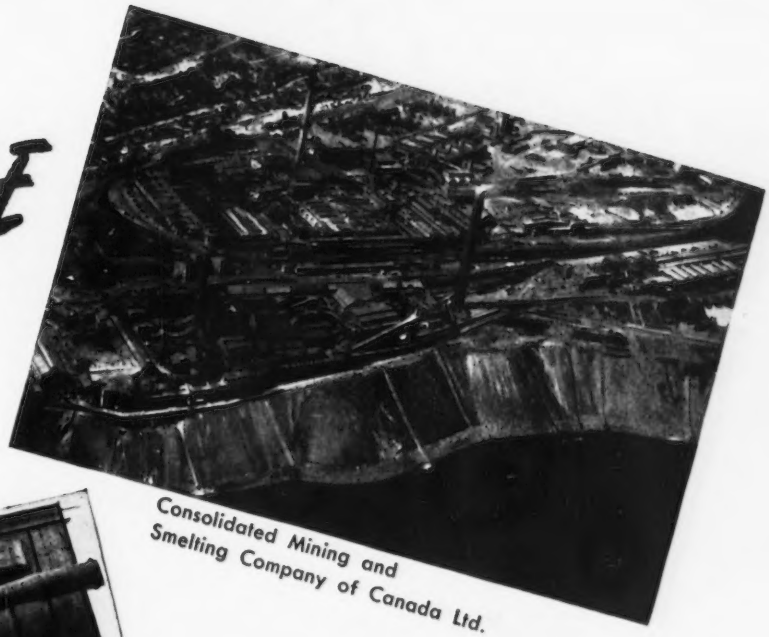


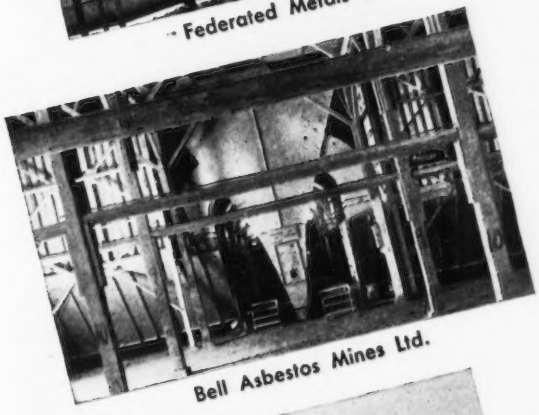
PLATE FEEDER, 20 in. x 5 ft., has babbitt-lined eccentric drive for easy adjustment, a 3-hp. motor speed reducer, belt drive and adjustable pitch sheaves permit close feed control. Lippmann Engineering Works. **(16)**

WHAT *DUSTUBE* EFFICIENCY MEANS

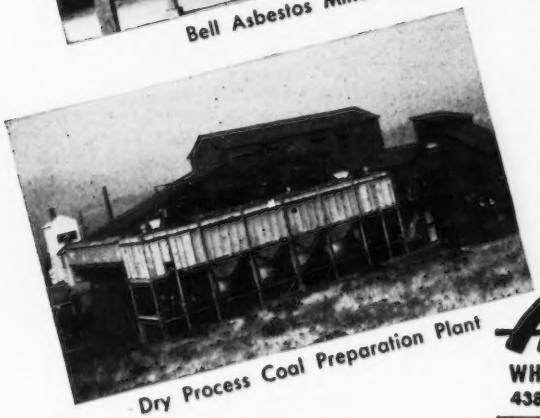


Consolidated Mining and Smelting Company of Canada Ltd.

Federated Metals Division



Bell Asbestos Mines Ltd.



Dry Process Coal Preparation Plant

in the *MINING* and *METALLURGICAL INDUSTRY*

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NEW BOOKS

Structure of Metals. By Prof. Charles S. Barrett, University of Chicago. New second edition. This standard text still deals, as before, with the atomic arrangement in metals (solid and liquid), but gives particular attention to recent advances in the field. The first part of the book covers crystal structure and methods of determining it; while the second presents comprehensive summaries of published literature on the structure of metals and alloys, preferred orientation of grains, and various theories pertaining to the structure of metals. Published by McGraw-Hill Book Co., 330 West 42 St., New York 36, N. Y. Pp. 661. Price $10.

Gypsum in California. By William E. Ver Planck. A complete and profusely illustrated report on the geology, mining, processing, and marketing of gypsum in California. Published as Bulletin 163 by the California Department of Natural Resources, Division of Mines, Ferry Building, San Francisco, Calif. Pp. 151 plus maps.

The Basis of Mine Surveying. By M. H. Haddock, formerly principal of Coalville Mining and Technical College. After having spent many years in training students in mine surveying, the author observed that troubles encountered by an engineer in both student and professional life, arose from "a too superficial acquaintance with the foundation of the subject." Hence the book does not attempt to invade the realm of practical surveying, but stresses the real mathematical basis of surveying. After mastering this, the student's practical problems become minor. Published by Messrs. Chapman & Hall, 37 Essex St., London W.C. 2. Pp. 301. Price 30s.

Textbook of Engineering Materials. By Melvin Nord, Associate Professor of Chemical Engineering, Wayne University, Detroit, Mich. This textbook is written for engineering students in their freshman-sophomore years. Various chapters cover sources of raw materials and their recovery from minerals; major processes of mineral dressing and extractive metallurgy; properties of engineering materials; and a wide range of specific materials such as water, fuels, explosives, metals, stone products, glass, wood, rubber, plastics; and protective materials such as lubricants and surface coatings. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York, N. Y. Pp. 518. Price $6.50.

A Review of the Broken Hill Lead-Silver-Zinc Industry. By O. H. Woodward. Published by The Broken Hill Associated Smelters Proprietary, Ltd., Port Pirie, South Australia. This book includes a complete description and explanation of the huge and famous Broken Hill in enterprise in Australia. Topics covered include: Geology and mineralogy, mining, ore dressing, lead smelting and refining, manufacture of sulphuric acid, production of zinc, metal sales, and other subjects relating to the housing facilities, communities, transportation services, and water supply in the area. Pp. 400.

Ontario Mining Operations in 1951. Compiled by M. Reade. Published by Ontario Department of Mines, Toronto, Ontario. Pp. 122.

Geology of McCool Township. By J. Satterly. Published by Ontario Department of Mines, Toronto, Ontario. Pp. 30 plus maps.

Report of the British Guiana Geological Survey Department for the Year 1951. By Geological Survey Department, Georgetown, B. G. Pp. 135 plus numerous maps. Price $1. (4/2)

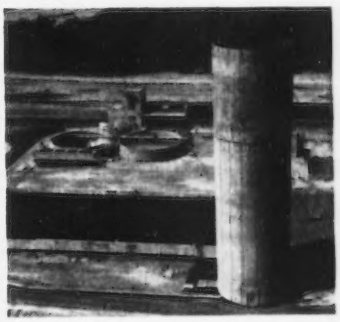
Our Water Resources—How Should They Be Developed? This booklet has outlined the methods which the businessmen of the country, acting through the Chamber of Commerce of the United States, think should be followed for the wise development and use of our water resources. Among the men who served on the Natural Resources Committee of the Chamber of Commerce, which sponsored this booklet are: R. C. Klugescheid, vice president of Kennecott Copper Corp.; Lawrence Litchfield, Jr., president of Alcoa Mining Co.; Richard A. Young, vice president American Zinc, Lead & Smelting Co.; Horace M. Albright, president of United States Potash Co. Copies of the booklet are available through the Natural Resources Department, Chamber of Commerce of the United States, Washington, D. C.

Geology. Part of a Merit Badge Series. Published by the Boy Scouts of America, 2 Park Avenue, New York 16, N. Y. If you want to know what a Boy Scout has to learn and do to pass his Merit Badge test in geology, this booklet will give you the answer. Subjects covered include physical, structural and historical geology; economic geology; mineralogy; petrology; and a concluding chapter entitled "Why be a geologist?" Acknowledgement is expressed in this book to many competent geologists who aided in the preparation of the material. The Boy Scouts of America is to be complimented for its constructive work in introducing the subject of geology to today's youth. Available at the Boy Scouts of America, 2 Park Ave., New York 16, N. Y. Pp. 84. Price 25¢.

(Continued on page 185)

what's NEW in Engineering

Supersonic waves pulverize rock in a new milling machine. Recently demonstrated at Reno, Nev., by its inventor Joseph Bassick, the machine turns nonmetallic rock to powder instantly. Crushing impact is delivered by sound waves. It promises to work on metals, too.



How to produce a ton of steel using only 1400 gallons of water—instead of the industry average of 65,000 gallons—was the problem facing Kaiser Engineers in building the West's only completely integrated steel mill at Fontana, Calif. For details, just drop us a line. We'll send you a reprint of a recent article about it in *Plant Engineering* magazine.

A new gadget—the pocket-sized double right angle prism—is proving a boon to many engineers in the field. Major advantage is the fact that you can look through it—straight ahead on the line of sight—and at a right angle at the same time.

"Engineering Statistics and Quality Control" is an important new book by Irving W. Burr, professor of mathematics at Purdue. Due for July publication, it is clear, unified, practical. Primary emphasis is on statistics most immediate and usable in industry.

Our new experience-record book shows Kaiser Engineers is now designing and building in such diverse fields as petroleum refining, mining, industrial and municipal waste and water treatment plants. For your copy, just write: Kaiser Engineers Division of Henry J. Kaiser Co., Kaiser Bldg., Oakland 12, Calif.

MARKETS—Trends and Prices (Continued from page 69)

Copper Production by Countries

(American Bureau of Metal Statistics)

Production of copper by countries that account for most of the free world's supply, in short tons:

	Jan.-Dec. 1951	Jan.-Dec. 1952	Jan. 1953	Feb. 1953	Mar. 1953
United States (a)	964,589	961,886	78,124	(e)75,172	82,213
Canada (c)	269,971	258,868	23,824	20,897	(f)
Mexico (crude)	60,511	60,874	5,323	4,732	5,608
Chile (blister and/or refined) (d)	396,937	414,101	35,128	33,738	(f)
Peru (blister and/or refined)	25,495	23,391	1,670	1,316	2,125
Federal Republic of Germany (refined, including scrap) (b)	234,647	214,843	18,447	16,326	(f)
Japan (refined), includes scrap	100,254	104,042	6,856	7,089	7,806
Australia (crude)	16,984	22,759	1,308	(f)	(f)
Union of South Africa (blister and/or fire refined)	36,104	37,345	3,447	(f)	(f)
Rhodesia (crude)	349,667	327,191	26,007	22,038	28,636
Totals	2,455,159	2,425,300	200,134	.....	.....

(a) Reported by Copper Institute as "recoverable contents of mine production or smelter production or shipments and custom intake." Does not include intake of scrap nor of imported ore except that received from Cuba and Philippines. (b) In addition, there are quantities of scrap included in the electrolytic production, tonnage not obtainable. (c) Blister copper plus recoverable copper in concentrates, matte, etc. exported. (d) Does not include production of Paipote National Smelter. (e) Revised. (f) Not yet available.

Aluminum Output

Production of primary aluminum established an all-time high in March. Output totaled 104,460 tons, topping the previous high of October, 1943, by 10,410 tons.

There were no power restrictions or other obstacles impeding production other than those associated with bringing new plants to capacity operation.

The Bureau of Mines' data on production of primary aluminum in the U. S., in tons, follow:

	1951	1952	1953
January	67,954	76,934	89,895
February	62,740	72,374	92,649
March	70,022	77,069	104,460
April	67,701	76,880	....
May	67,720	80,803	....
June	67,454	77,476	....
July	72,698	78,368	....
August	73,816	85,175	....
September	69,429	76,882	....
October	72,647	77,312	....
November	72,246	74,639	....
December	72,454	83,419	....
Totals	836,881	937,331	....

Miscellaneous Metals, Ores, Minerals

Quotations cover wholesale lots, prompt shipments f.o.b. New York unless otherwise stated

MISCELLANEOUS METALS

May 29, 1953

Aluminum ingot, 99 plus percent, lb.	20½c.
Antimony, spot, lb., 5 tons and up but less than carload, packed in cases	37.97c.
Bismuth, ton lots, lb	$2.25
Cadmium, commercial sticks, delivered, lb	$2.00
Calcium, lb., ton lots, 98 percent, cast	$2.05
Chromium, 97 percent grade, lb., contract	$1.18
Cobalt, 97 to 99 percent, per lb.	$2.40
Germanium, lb.	$340.00
Indium, troy oz.	$2.25
Lithium, lb., 98 percent	$11.00 @ $14.00
Nickel, cathodes, lb., f.o.b. Port Colborne (a)	60c.
Magnesium, 99.8 percent, carloads, lb., producer's plant, Freeport, Texas	27c.
Palladium, troy oz.	$24.00
Platinum (Official quotation wholesale lots) troy oz.	$90.00
Quicksilver, flask of 76 lbs., 25 flasks or more	$195 @ $197
Selenium, 99 plus percent, lb.	$4.25 @ $4.75
Silicon, minimum 97 percent, carloads, lb.	18½c.
Tellurium, lb.	$1.75
Thallium, 100 lb. or more, lb.	$12.50
Titanium, 99.3 plus, lb.	$5.00

(a) Includes U. S. duty.

METALLIC ORES

Beryllium Ore, imported, 10% BeO, per unit	$46.00 @ $48.00
Chrome Ore, per long ton, f.o.b. cars Atl. ports, dry	
44% Cr_2O_3 no ratio	$27.00 @ $32.00
48% Cr_2O_3 3 to 1 ratio	$44.00 @ $56.00
Iron Ore, Lake Superior, Lower Lake ports, long ton:	
Old Range bessemer	$10.10
Mesabi bessemer	$9.85
Mesabi, non-bessemer	$9.70
Lead (Galena), 80 percent, Joplin, Mo., ton	$162.90
Manganese Ore—Per long ton unit of Mn basis 48 percent manganese, nearby positions, subject to premiums and penalties, $1.18 @ $1.21 c.i.f. U.S. ports, duty extra. Long-term contract nominal at 90c. to 93c., c.i.f. duty extra.	
Molybdenum Ore, 90%, per lb. of MoS_2 f.o.b. mines	60c.
Tantalite, 60% concentrate, per lb.	$2.50 @ $3.00
Tungsten Ore, per unit of WO_3	
Foreign, 60 percent, c.i.f. U.S. ports	$41.00 @ $42.00
Domestic, scheelite, 60 percent f.o.b. mill	$63.00 @ 65.00
Vanadium Ore, per lb. of contained V_2O_5 f.o.b. mines	31c.
Zinc Ore, Prime, 60 percent concentrate, Joplin, Mo., per ton	$65.00

(a) F.o.b. port of shipment.

METALLIC COMPOUNDS

Arsenous Oxide (arsenic trioxide) lb., in bbl. carload lots delivered	5½c.
Cobalt Oxide, 72½ to 73½%, ceramic grade, per lb.	$1.82 @ $1.84½
Copper Sulphate, 100 lb.	$10.35
Germanium Oxide, lb.	$142.00

ALLOYS

Ferrochrome, 65 to 69 percent, per lb. of Cr contained	24¾c.
Ferromanganese, 78 to 82 percent, gross ton, seaboard	$225
Ferromolybdenum, 55 to 65 percent Mo. lb. of Mo. contained	$1.32
Ferrosilicon, 50 percent, per lb. of contained Si	12.4c.
Ferrotungsten, 75 to 80 percent, lb. of W contained	$4.35
Ferrovanadium, per lb. of V delivered	$3.00 @ $3.25
Silicomanganese, Max. 1½ percent carbon, per lb. contracts	11.4c.
Spiegeleisen, per long ton, 19 @ 21 percent grade	$85.00

NON-METALLIC MINERALS

Asbestos, f.o.b. Canada (Quebec) mines (U. S. funds) ton:	
Crude No. 1	$960 @ $1,500
Crude No. 2	$595 @ $900
Spinning fibers	$321 @ $514
Shingle fibers	$150 @ $200
Paper stock	$109 @ $137
Waste	$77
Shorts	$35 @ $70
Asbestos, Vermont, f.o.b. Hyde Park:	
Spinning fibers	$279.50 @ $302.00
Shingle stock	$135.00 @ $162.00
Paper stock	$81.50 @ $115.00
Waste, stucco or plaster	$71.40
Refuse or Shorts	$34.00 @ $63.00
Barytes, f.o.b. mines:	
Georgia, crude, per long ton	$13.00 @ $14.00
Missouri, 94 percent $BaSO_4$, per short ton	$12.00
Bauxite, long ton, f.o.b. point of shipment:	
Domestic, crude, 50 to 52 percent (not dried)	(a) $5.00 @ $5.50
Domestic, chemical, 55 to 58 percent	(a) $8.50 @ $9.50
Domestic, abrasive, 80 to 84 percent	(a) $18.00 @ $18.50
China Clay, f.o.b. mines, ton:	
Georgia, filler and ceramic grades	$8.50 @ $9.50
North Carolina ceramic grade	$20.25 @ $22.25
Feldspar, bulk ton:	
Potash or soda feldspar, 200 mesh, ceramic grade	$18.50 @ $22.25
Glass feldspar, white, 20 mesh	$11.75 @ $12.50
Fluorspar, f.o.b. mines, bulk, 70% effective ton	$42.50
60% effective CaF_2	$38.00
Acid 97% concentrate, bulk, ton	$60.00
Fuller's earth, f.o.b. Georgia or Florida, ton	$7.00 @ $14.00
Magnesite, per ton dead-burned, bulk, f.o.b. Washington	$39.56
Mica—Domestic, f.o.b. mines. Punch 12 to 22c. per lb. according to size and quality. Sheet clear, 1½ x 2 inch, 80 to 85c.; 2 x 2 inch, $1.10 to $1.20; 2 x 3 inch, $1.50 @ $1.60; 3 x 3 inch, $1.80 @ $1.90; 3 x 4 inch, $2.20; 3 x 5 inch, $2.40; 4 x 6 inch, $3.15; 6 x 8 inch, $4.25. Wet, ground, very fine, $140 @ $155 per ton. Bulk sales, dry ground: $32.50 @ $70.00 per ton Scrap $32 and up.	
Ocher, Georgia, ton, in sacks	$26.25
Pyrites, Spanish, per long ton unit of S, c.i.f. Atlantic ports	Nominal
Sulphur, Texas, mines, long ton	$25.50 @ $27.50
Talc, f.o.b. works, ton:	
New York, purified	$18.50 @ $20.00
Vermont, extra white	$12.50
Tripoli, Missouri, ton:	
40 mesh, cream colored	$30.00

(a) Nominal.

IRON AND STEEL

Pig iron, gross ton, basic, Valley furnaces	$54.50
Steel, f.o.b., Pittsburgh billets, net ton	$59.00
Structural shapes, 100 lb.	$3.85

KENNEDY PRESENTS THE GREATEST IMPROVEMENT
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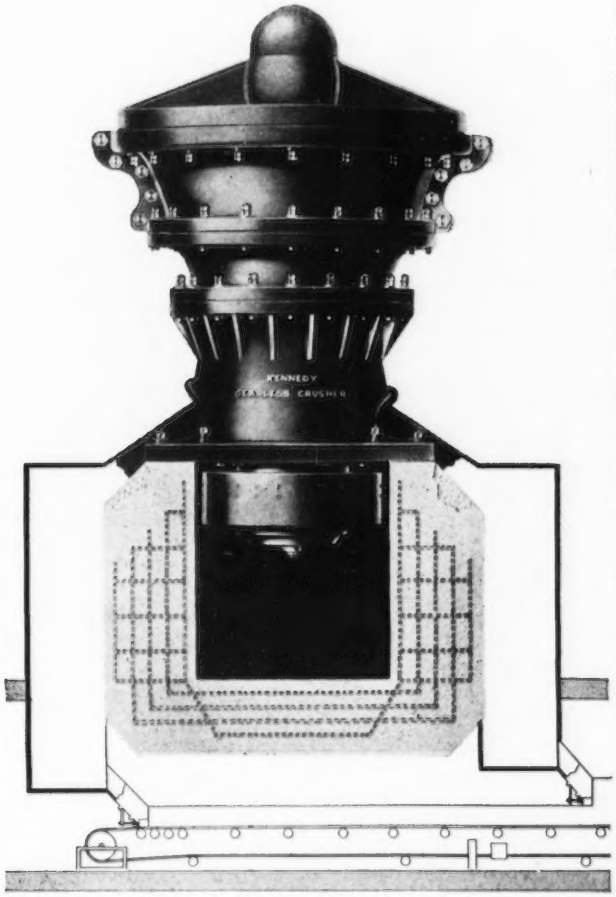
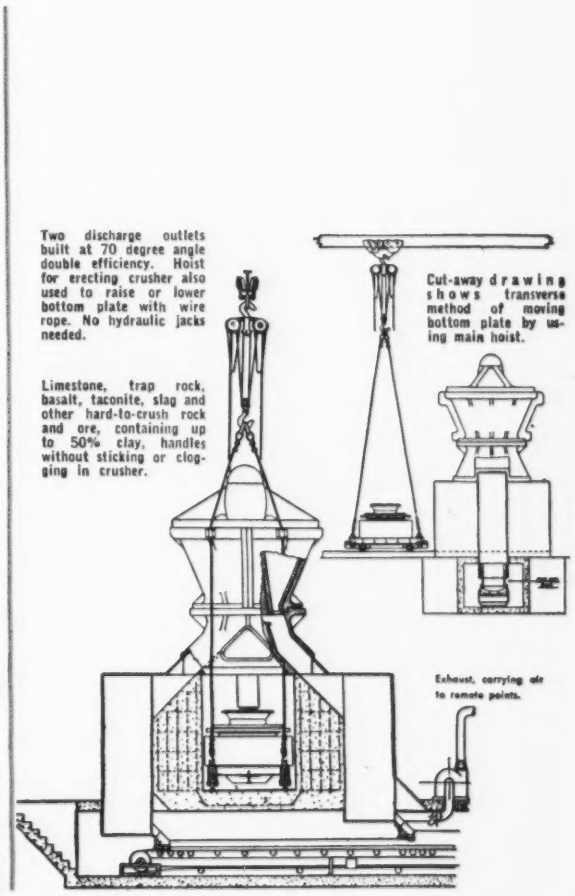
NEW DOUBLE DISCHARGE GEARLESS GYRATORY CRUSHER WITH TWO OUTLETS . . . *ENDS THE "STICKY ORE" PROBLEM!* Double discharge outlets built at 70 degree angle solve "sticky ore" problem! Easily crushes ore containing as high as 50% clay without clogging. Synchronous motor built into pulley assembly for sure crusher starting even when full of rock and ore. Gearless construction, frictionless operation. All moving parts carried on self-aligning roller bearings. Power is used only for the actual crushing. Economical recirculating forced-feed oil system. Automatic power shut-off. Primary, secondary types for any tonnage and sizing requirements.




Two discharge outlets built at 70 degree angle double efficiency. Hoist for erecting crusher also used to raise or lower bottom plate with wire rope. No hydraulic jacks needed.
Limestone, trap rock, basalt, taconite, slag and other hard-to-crush rock and ore, containing up to 50% clay, handles without sticking or clogging in crusher.
Cut-away drawing shows transverse method of moving bottom plate by using main hoist.
Exhaust, carrying air to remote points.

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PERSONAL NEWS

FELIX E. WORMSER was sworn in April 24 as Assistant Secretary for Mineral Resources of the Department of Interior at a White House ceremony, by Frank K. Sanderson, White House administrative officer, with President Eisenhower as an interested witness. Mr. Wormser will have supervision over the Bureau of Mines, the Geological Survey, Division of Geography, and the Division of Oil and Gas. He was born in Santa Barbara, Calif., on Oct. 31, 1894. He received a degree in mining engineering from Columbia University in 1916 and is a veteran of World War I. For a time he was on the editorial staff of *E&MJ*. He was vice president of the Lead Industries Association, and later a vice president of the St. Joseph Lead Co.

Earl S. Mollard has been appointed general manager of the M. A. Hanna nickel mining and smelting operations at Riddle, Ore. Mr. Mollard has been assistant general manager of Hanna's Minnesota operations since 1948. Before that he had been manager of Butler Bros.' mines at the time M. A. Hanna took them over. **E. Emmons Coleman** has been appointed plant manager of the smelting operation. Previously, he has been general manager of Bradley Mining Co.'s electric furnace plant at Stibnite, Ida., since 1950. Mr. Mollard and Mr. Coleman will make their headquarters at Riddle, where construction has already started on the ferronickel plant.

Randolphe William Diamond, of Trail, vice president of Consolidated Mining & Smelting Co.'s Western region, has been awarded the Institute of Metals Platinum Medal for 1951 for "outstanding service to the nonferrous metals industries." First Canadian to win the award of the institute, a British organization with branches in all parts of the world, Mr. Diamond has been with Cominco since 1917 and has received recognition for new methods in the extraction of ore.

In the recent reorganization of H. W. Gould & Co., **Malcolm B. Gould** has become president, succeeding **Bruce A. Gould.** The company announces plans for an extensive exploration program in California and bordering states with a view to the production of metallic and non-metallic ores.

G. B. Campbell is now assistant metallurgical engineer at ALCOA's reduction works at Wenatchee, Wash.

Kenneth Larsen, recent graduate in geological engineering from the University of Utah, enters the Air Force in June as an officer.

DR. A. W. SCHLECHTEN, chairman of the department of metallurgical engineering at the University of Missouri School of Mines and Metallurgy, who with J. Bruce Clemmer, chief of the Salt Lake City Station of the U. S. Bureau of Mines, represented the United States at a series of metallurgical conferences sponsored during April and May in Europe by the Organization for European Economic Cooperation.

Cleveland-Cliffs Iron Co. elected **Walter A. Sterling** president and member of the board of directors at a meeting on May 20. He succeeds **V. P. Geffine** as a member of the board, but Mr. Geffine continues as vice president. **Alexander C. Brown** continues as chairman and chief executive officer and **Edward B. Greene** remains honorary chairman. Mr. Sterling's most recent position with Cleveland-Cliffs was vice president in charge of mining operations, a post he took in 1950 after a career with the company that began in 1919.

Carlos E. Milner, Jr., formerly resident mine geologist for Silver Star-Queens Mines, Inc., at Hailey, Ida., has become district manager of the Phoenix office of Copco Pacific, Ltd.

Robert L. Hoffman, is now on the production staff of the Eagle-Picher Co.'s Mining & Smelting Division at Cardin, Okla.

After 32 years service in the U. S. Bureau of Mines, **Henry A. Doerner,** who retired as Chief of the Metallurgical Division Region III, is now doing consulting work in San Francisco. He is specializing in the treatment of "rare" ores and in the use of radioisotopes in research.

A. M. Dixon is with Basic Refractories, Inc., at Gabbs, Nev.

After nine years in Peru and Bolivia, **J. R. Bryce** has returned to the States to act as purchasing agent for small mines that do not have their own U. S. offices. He works from New Brunswick, N. J.

Odin A. Sundness, Duluth, vice-president and general manager of iron ore operations for Snyder Mining Co., was chosen "engineer of the month" (April) by the "Minnesota Engineer," official publication of the Minnesota Federation of Engineering Societies.

David A. Bruneau, purchasing agent at the Duluth office of Pickands, Mather & Co., has been transferred to the purchasing department of the Cleveland office. Other changes and transfers in P. M. & Co.'s offices are as follows: **Richard A. Mann** has been transferred from the Albany mine to the Sagamore mine on the Cuyuna range. He succeeds **Thomas F. Rundle,** retired. . . . **Robert L. Burns** is now in the industrial relations department at the Duluth office . . . **William McNelly,** engineer at the Mahnomen mine, on the Cuyuna Range, has been transferred to the range district office. **Donald Virant,** of the district engineering department, replaces him as mine engineer at the Mahnomen. . . . **Alex A. Griffin,** mine clerk at the Mahnomen, has been transferred to the Rabbit Lake mine. . . . **Richard**

When is it economical to

HARD FACE Crusher Mantles and Liners?

THERE'S a right and wrong time to hard-face crushers. No equipment can be *economically* salvaged if too severely worn. *But you can increase service life 2 to 3 times for a modest cost if you don't delay too long!*

HARD-FACE WHEN NEW. Best time to hard-face is when mantles and liners are new or when wear patterns first develop. Build-up costs are then low. Repeat hard-facing as deposits wear away—and crushers will give many, many times ordinary service.

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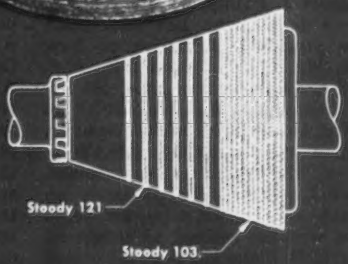

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*The Stoody Guidebook will soon be available in a Spanish translation.

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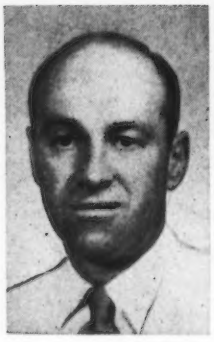


F. V. RICHARD

R. M. BELLIVEAU

W. C. BALL

ASARCO Announces Major Personnel Changes

American Smelting and Refining Co. announces the following changes: **Dr. Albert J. Phillips,** director of the research department, has been made a vice president. A native of New Haven, Mr. Phillips holds B.S., M.S. and Phd. degrees from Yale. He became associated with ASARCO in 1931 and, before being named director, was first superintendent, then manager of the research department. **Howard L. Goodenough,** formerly an assistant comptroller, succeeds **E. C. Corson,** who has retired, as comptroller. **David B. Blake** has been appointed general traffic manager, with headquarters in N. Y., succeeding **O. W. Tuckwood,** vice president, who has resigned.

Changes in ASARCO's mining department include the following appointments: **Clement P. Pollock** has been named exploration manager with headquarters in N. Y. Formerly chief geologist of ASARCO's Northwestern department, last year Mr. Pollock was made assistant to vice president R. F. Goodwin. **L. H. Hart,** formerly resident engineer, N. Y., has been appointed as the chief geologist there. After serving 20 years with Anaconda Copper and U. S. Smelting he joined ASARCO in 1946, spent two years on foreign assignments, was made exploration engineer at Salt Lake City, became assistant general manager of the Western mining department there, and was transferred to N. Y. in 1951. **D. J. Pope,** formerly general manager, Western mining department, has been appointed assistant to vice president Goodwin in N. Y. His nearly 30 years with the company have included assignments in various Western divisions. **J. E. Berg** has been named general manager of the Northwestern mining department with headquarters at Wallace, Ida. A graduate of the University of Wisconsin, Mr. Berg was formerly with the Federal Mining and Smelting Co., where he last held the position of general manager.

Other mining department changes are as follows: **F. V. Richard,** who was recently appointed manager of operations, Western mining department, has been named manager of that department, with headquarters at Salt Lake City. He has been employed by the company since his graduation from the Mining College of the University of California in 1933. **R. M. Belliveau** has been named resident engineer with headquarters in N. Y. He holds B.S. and M.S. degrees from the University of Southern California and his background includes 12 years in railroad work and 19 in mining. He joined the ASARCO N. Y. mining staff in 1951. **Ward C. Ball,** who had been general superintendent, Tri-State Properties, Federal Mining and Smelting Co., has been made general superintendent, Tri-State Properties, American Smelting and Refining Co., with headquarters at Baxter Springs, Kansas. He is familiar with all phases of mining and milling practices in the Tri-State area.

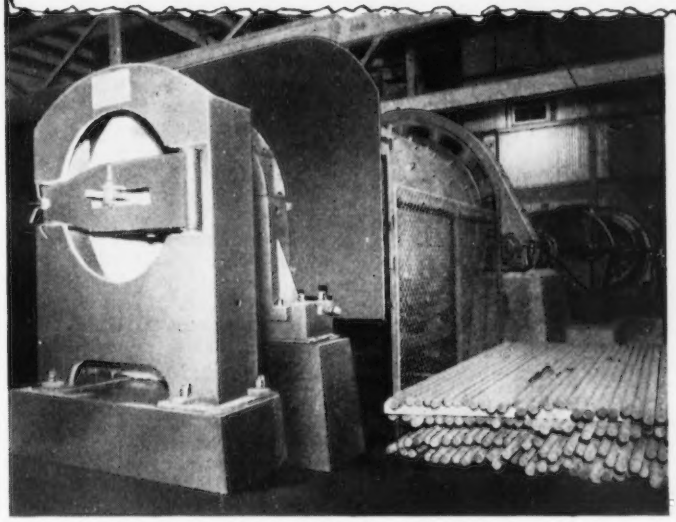
Hawkinson, assistant chief engineer in the Hibbing district, has been transferred to the new West Hill mine as district engineer. **C. R. Knowles** succeeds him. . . . **Ed. Martinson,** engineer at P. M.'s Bennett mine for 15 years, succeeds **Richard A. Mann** at the Albany mine. . . . **Harry Gerber,** research engineer, has been appointed general plant foreman with headquarters at the Erie Mining Co.'s laboratory, Hibbing. Erie is managed by Pickands, Mather & Co.

Judson C. Travis has been elected president of Handy & Harman, after 35 years of service with the company.

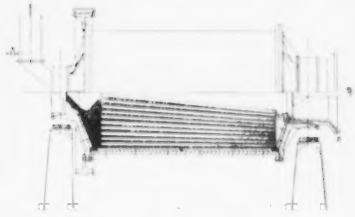
Robert W. Lea, former president of Johns-Manville Corp., and presently a director of Olin Industries, Inc., has been elected to Olin's executive committee.

John E. Urquhart, former general superintendent of operations at Woodward Iron Co., has returned to become president and director, succeed-

How MARCY Rod Mills Improve Fine Crushing



MARCY OPEN END LOW PULP LINE GRINDING IMPROVES FEED FOR SECONDARY BALL MILLS



The Marcy principle of low pulp line, fast discharge of mill content results in lower overall costs than when dry crushing is used... the discharge is more uniform, a higher percentage of discharge is finished product. Thus the load is lightened or capacity increased, on the final stage of grinding.

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A large copper-lead-zinc producer recently ordered 7—7'x12' Marcy Open End Rod Mills for crushing a 1" feed to a 10 mesh ball mill feed.

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ing **B. C. Colcord,** who has resigned. Other changes include: promotion of **T. H. Kirk** to chief mining superintendent; transfer of **Paul Ford** to succeed Mr. Kirk as superintendent at Mulga; appointment of **M. T. Gilchrist** to fill Mr. Ford's post as superintendent at Dolomite; naming of **John Hager,** formerly chief mining engineer, as general superintendent of mines, succeeding vice president **Hewitt Smith** in that post.

Gordon McCulloch has recently been appointed mechanical and electrical superintendent at the Howe Sound Co.-Chelan Division, Holden, Wash.

A. D. Molohon, regional administrator of the Bureau of Land Management's Region III, at Billings, Montana, is vacating that post the middle of June for a 2-year assignment as an advisor to the Government of Israel under the Point Four program.

Arthur P. Nelson left his position as general superintendent of Federal Mining & Smelting Co.'s Morning mine at Mullan, Ida., to become assistant general manager of Minas de Matahambre, Cuba's largest copper mine. A graduate of the University of Idaho School of Mines, Mr. Nelson had been with Federal for 18 years.

Dr. William E. Wrather is to remain director of the Geological Survey, following the refusal of Secretary of the Interior **Douglas McKay,** in April, to accept his resignation. Secretary McKay expressed his "confidence in Dr. Wrather's loyalty, integrity, and professional ability" in a letter requesting him to continue as director.

A bronze statue, to be placed in the rotunda of the Utah State Capitol in Salt Lake City, will be erected to honor **Daniel C. Jackling,** discoverer and developer of the Bingham Canyon open pit copper mine, now largest single copper producer of its type.

JOUETT SHOUSE who was recently elected chairman of the board of Anton Smit & Co., Inc., of New York, industrial diamond firm. A former member of Congress, and Assistant Secretary of the Treasury under Woodrow Wilson, Mr. Shouse joined the board of directors of the firm in 1950 and had served as its counsel until his appointment as chairman.

Ohio Brass Co., Mansfield, Ohio, announces that **W. R. Cress** is being transferred to the Chicago area as a district manager, and **V. L. Crabb** has been named district manager in the Cincinnati area.

M. M. Schratz, controller of Aluminum Company of America since 1947, has been elected to a newly-created vice presidency by ALCOA's Board of Directors.

HORACE Y. BASSETT, since 1947 vice president and general manager of the Wolverine Tube Division of Calumet & Hecla, Inc., has been named vice president of operations of Calumet & Hecla. He will transfer from Wolverine Tube's divisional headquarters in Detroit to the newly established C & H executive offices in Chicago.

DON W. BLEND has been named general manager of the Wolverine Tube Division of Calumet & Hecla, Inc. He succeeds Horace Y. Bassett

The opening of Calumet & Hecla's new executive offices in Chicago in April coincided with the announcement of the following personnel changes: **C. Chester Young** is now vice president of finance; **Francis J. Gibbons** is named controller; **W. F. Jones,** who is transferring to Chicago from Calumet, Mich., will be in charge of centralized purchases of copper scrap and other secondary metals. William W. Lynch, vice president of C & H, whose office is in N. Y., will now be in charge of the entire metal sales and procurement programs, including both refined and scrap copper.

Eugene P. Reed, assistant to the manager of raw materials of Tennessee Coal & Iron Division of U. S. Steel at Birmingham, Ala., has been named assistant manager of raw materials.

Chile Exploration Co. at Chuquicamata, announces the following promotions: **Glen S. Wyman,** previously mine superintendent, named general superintendent of operations, succeeded by **L. E. Fish,** formerly assistant mine superintendent; **R. C. Becker,** formerly chief mine engineer, appointed assistant mine superintendent.

Ed C. Green, assistant general manager of the Chino Mines division, Kennecott Copper Corporation, at Hurley, has been transferred in the same capacity to the Utah Copper Company at Bingham, Utah. **E. A. Slover,** succeeds him.

OBITUARIES

Clarence E. Abbott, of Raleigh, N. C., who retired some years ago as vice president of Tennessee Coal, Iron & Railroad Co. (U. S. Steel), Birmingham, Ala., died at his home on April 14.

Lewis E. Dunham, 89, former executive of the M. A. Hanna Co., died April 15 in Cleveland.

Maurice W. Summerhays, retired general manager and director of Wright-Hargreaves Mines, passed away in April in Duncan, B.C., at 80. Continuing as consultant at Wright-Hargreaves until his death, he had also served as manager of Porcupine Crown Mines in Ont.

John Davenport, 65, president and founder of Franklin Mineral Products Co. of Franklin, N. C., died April 7 while visiting a daughter in Toronto, Canada.

Dwight D. Guilfoil, 66, vice president and general sales manager of Sauerman Bros., Inc., died of a heart attack in his home in Chicago on May 3.

Truman Delmar Prier, 72, died April 10 at his home in Golden, Col. After graduating from Colorado School of Mines, he worked as a mining engineer at Ruby, Mont.; he went to Breckenridge, Colo., in 1919 and was active in gold mining there until his retirement in 1948.

Active in Western mining circles until World War II, **O. J. Dennhardt** died in January at the age of 70.

Charles Colcock Jones, III, 87, retired mining engineer who rehabilitated the Iron Mountain mine near Keswick, Cal., discovered the intermountain phosphate fields of Idaho, Wyoming and Utah, and owned the Vulcan iron deposits at Kelso, Cal., until 1942, died April 23.

Carl E. Johnson, 69, one of the founders of Sterling Electric Motors, Inc., died March 26 at his home in San Marino, Cal.

STANDARD ENGINEER'S REPORT

DATA

LUBRICANT Calol SA Grease

UNIT 4½" anti-friction bearings

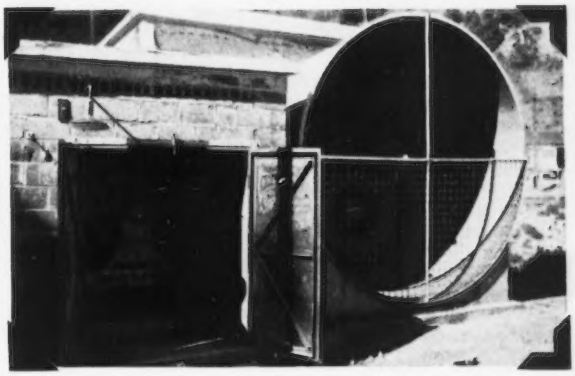
LUBRICATOR Grease gun

CONDITIONS Continuous operation, extreme temperature variations

PERIOD 4 Years

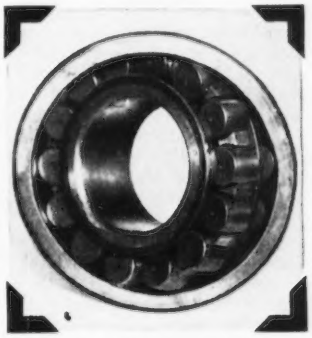
FIRM U.S. Fuel Company, Hiawatha, Utah

Special grease stays soft at 20° below zero!



PUMPING 250,000 CUBIC FEET OF AIR PER MINUTE at the King Mine, Hiawatha, Utah, this exhaust fan must work continuously in a place where winter temperatures often reach 20° below zero. Even in this extreme cold, Calol SA Grease stays soft—does not channel, allow grease starvation and loss of bearings as was the case when other greases were used. Since using Calol SA Grease, U. S. Fuel Company has had no trouble with fans, a major point since men must be brought out of the mine if fan stops.

CALOL SA GREASE has been used by the King Mine in 4½-inch bearings like this for more than four years. They have not lost or changed any bearings in that entire period! They have also used Calol SA Grease to lubricate mine car wheels—and it stayed in, did a good job, even under heavy loads!



REMARKS: Calol SA Grease has a wide range of uses. It is especially valuable for anti-friction and plain bearings operating in extreme temperatures.

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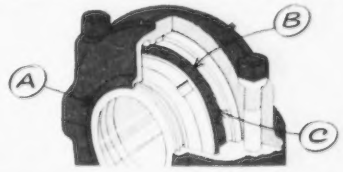

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WASHINGTON IMPACT

Morton A. Reichek, McGraw-Hill Washington News Bureau

DMPA Closes Shop After Two-Year Run—Eisenhower's Stand Dims Tariff Prospects

THE DEFENSE MATERIALS Procurement Agency will close up shop this month after more than two years (including nine months as the Interior Department's Defense Minerals Administration) stimulating private mining expansion. Unless the cold war takes a significant turn for the worse, you can look at DMPA's demise as finis for the Government's mining expansion programs.

DMPA has been extremely sensitive to criticism that too much foreign expansion was fostered. Agency officials like to point out that the bulk of the expansion has been accomplished from "domestic and other North American sources."

Latest estimate on gross value of all materials and services involved in DMPA contracts and purchase programs is nearly $6-billion. Estimated net cost to the Government under these commitments is $560-million. The foreign mining expansion programs, started in 1949 by the now-defunct ECA and continued by MSA and DMPA, involve U. S. cash advances of about $35-million and the equivalent of $100-million in foreign counterpart funds. Funds advanced by the U. S. are repayable in deliveries of metals and minerals here.

DMPA administered 41 metal and mineral expansion programs, excluding aluminum (handled by DPA and later ODM). All the programs are now at least 90% under way, with these exceptions: Cobalt, and battery and chemical grades of manganese ore (75-89%); nickel and calcined diatomite filter aids (50-74%); selenium and chemical grade chromite (less than 50%).

DMPA assistance in domestic mining expansion has been in the form of purchase contracts, loans, and accelerated tax amortization. Most of the expansion has been privately financed, aided by fast tax write-off. DMPA recommended the issuance of 340 tax write-offs for mining projects, in which private investment totals at least $1.5-billion. Iron ore and taconite account for 135 of the projects, representing amortized investment of more than $1-billion. Copper is next with about $178-million expansion.

As claimant agency for the mining industry, DMPA also certified nearly 100 mine-access road construction projects, issued priorities for procurement of about $700-million worth of mining equipment, and dealt with manpower, housing, transportation, and power problems.

Although DMPA is now out of the picture, the Government retains authority to encourage mining expansion through emergency assistance. But it appears unlikely that the expansion goals will be boosted. A tipoff came last month on the mood of Congress, when the House Appropriations Committee killed a $225-million stockpile request for fiscal 1954 and voted no new funds. (However, $457.6-million remain on the books as unobligated stockpile funds appropriated in previous years.)

Future Government Problems

The Government is preparing for problems that will arise in administering the long-term contracts. The major one anticipated: What to do with premium-price metal the Government will be obligated to buy when producers are unable to sell on the open market? Examples: 17¢ lead and zinc, and 30¢ copper, also aluminum, two years from now.

One authoritative estimate of such tonnage: perhaps 20% of the nearly $3-billion gross commitment in metal and mineral floor-price contracts. Obviously the problem was not seriously considered when the expansion program began. There was no provision to cover the situation in the original defense production law.

Stretch-outs in the defense program made the problem apparent. ODM officials considered such solutions as these: (1) Although stockpile objectives may have already been met, buy the surplus metal for the stockpile, without charge to stockpile funds, and cancel equivalent Treasury Department borrowing authority; (2) cancel the purchase contract and negotiate anticipated profit for the producer; (3) cancel the contract and compensate the producer for costs.

Requiring the stockpile to take unneeded metal did not appeal to Treasury Secretary George Humphrey and Studebaker president Harold Vance, who is a special ODM consultant. They both objected at first. But other alternatives looked less attractive. Even worse was the final alternative: the Government buying the metal at a support price, then selling on a depressed market, thereby making for increased uncertainty.

The stockpile proposal was selected as the easiest way out. An appropriate provision has been put into the Capehart Mobilization Bill, which is expected to become law by July 1, granting the President adequate authority to buy the stockpile and cancel out the borrowing authority. The new authority is similar to legislation enacted after World War II on excess RFC-held metal. In effect, as one ODM official says, "An appropriation in hindsight is made for the stockpile with a minimum effect on depressed markets."

The most common type of problem involves what government lawyers call "over-run costs." Many mining companies that received DMPA cash advances on production, RFC loans, or accelerated tax amortization on private-financed expansion now find that actual costs exceed the cost estimates made when applying for Government assistance. It's estimated that about 20% of the mines participating in the Government's expansion program are in this category.

At least a dozen producers have now applied for fast tax write-off on additional costs. Several have received increased cash advances on their expansion projects from DMPA. The most celebrated case: The Westmoreland Manganese Corp. of Arkansas, which received a $3.8-million advance last year to produce 264,000 tons by 1959, and was then unable to meet its payroll two months ago.

Tariff Prospects Bleak

The outlook for a sliding-scale tariff on lead and zinc is bleak. A damper was put on tariff prospects during House Ways and Means Committee hearings last month by a Presidential statement on the issue, which was read into the record.

President Eisenhower agreed that "a strong domestic mining industry is vital to national security and to the continued prosperity of our country." He referred to "depressed conditions that prevail within many mining districts," but said the Administration must make its policy in this field consistent with other policies "essential to the security and economic welfare of this nation and other free-world countries."

The implication, of course, was his desire for free trade. The President also said he is "encouraging the Congress and agencies within the executive branch . . . to find a solution that is equitable to all concerned." He did not explain what he meant by this, however.

Over 20 witnesses testified in favor of the lead-zinc tariff, six in opposition. The opponents argued that the sliding-scale tariff would accentuate fluctuations in lead-zinc prices and supplies, increase consumer costs, discourage exploration and development of new foreign properties, and decrease supply during emergencies.

Some mining spokesmen here are

now unhappy that the lead-zinc tariff was tied to the controversial Simpson Bill, which is an omnibus bill on reciprocal trade. They believe lead-zinc tariff prospects would be better if the issue were considered on its own merits, apart from other aspects of foreign trade policy. Assistant Interior Secretary Felix Wormser and other sympathetic Government officials, they say, would then be able to advocate the issue to Congress, less restricted by broad administration policy.

Natural Resources Parley

The Mid-Century Conference on Resources for the Future will be held in Washington, Dec. 2-4, to study and debate the question: "How can the U.S. mobilize its resource base—land and its products, water, minerals, and energy—to support the continuously expanding demands of a growing population and assure sound economic growth and national security?"

Lewis W. Douglas, a one-time copper executive and former Ambassador to Great Britain, will be conference chairman.

The conference, which was originally scheduled for March, has been called by Resources for the Future, Inc., a non-profit research organization financed by the Ford Foundation. Horace M. Albright, president of U.S. Potash Co., is the organization's board chairman; Dr. R. G. Gustavson, chancellor of the University of Nebraska, is its president.

Special Minerals Panel

The conference will have a special non-fuel minerals panel to discuss such broad questions as those outlined in the following items:

1. What kind of stimulus can and should be provided the domestic mining industry by tax laws?

2. Should the domestic mining industry enjoy tariff protection as one way of stimulating domestic production, and, if so, to what extent?

3. To what extent should Government itself engage in direct exploration for metals and minerals as a way of diminishing the risk to private enterprise?

4. What should be done toward developing and applying new technology in the mineral industry?

5. Does the claim-patent system, as it exists in the laws governing mining activities on federal lands, need revision because of present abuses and in order to allow and encourage the use of new techniques of discovery? If so, can the revision be accomplished without reducing the stimulus the system provides to private enterprise?

6. What gaps in data, analysis, or both are most serious, and how might they best be filled—by federal or state government, industry groups, or private research organizations?

LABOR THIS MONTH

Joseph M. Gambatese, McGraw-Hill Washington News Bureau

TAFT-HARTLEY: Progress toward revision is slow. Congress is not likely to act until fall, if then. No real enthusiasm exists for a change. Labor leaders are certain that amendments will be unacceptable, and will try to block action by this Congress. Their gamble: The next Congress will be Democratic, more sympathetic to labor.

STATE LABOR LAWS: Union leaders hate them worse than Taft-Hartley. Thirteen states ban compulsory union membership. Many restrict strikes, picketing and secondary boycotts. Some force compulsory arbitration of utility disputes. That's why labor lobbyists fight plans to give the states a larger role in labor problems.

STATE LEGISLATURES: Organized labor fared well in the state capitols this year. Attempts to ban compulsory union membership were defeated in Utah, Colorado and other Western states. Only Arkansas and Oregon voted important labor curbs, imposing new restrictions on picketing.

WILL DURKIN QUIT? That question is being whispered more often in Washington as Secretary of Labor Martin P. Durkin's plight becomes more conspicuous. The Democrat, and Plumbers' Union-president-on-leave just doesn't seem to fit in Eisenhower's Cabinet. His views don't jibe with those of the Republican administration. He hasn't been "accepted" into the family circle by other Cabinet officers. Actually, Durkin is hurting what chance there may be to strengthen the Labor Dept. The Republican Congress just won't go along.

WAGE BOOST OUTLOOK: Under 10 c.—That is the pattern of hourly wage increases evident in settlements by Mine-Mill and other unions. The same will likely be true in basic steel. At Carlsbad, potash companies settled with Mine-Mill for wages totaling four cents above a year ago, only one cent above last July, and exactly equal to last August. Variation was due to an escalator clause, which is not retained in the new contract. A full cost-of-living bonus is put into base rate.

ON CAPITOL HILL: CIO Steel Workers got Sen. Murray of Montana to introduce the federal metal mine safety bill, but fear Mine-Mill backing will hurt chances of passage. It is unlikely that the Senate Labor Committee will hold hearings this session. . . . Both unions are also supporting Sen. Murray's premium price bill aimed at alleviating the lead-zinc situation. . . . George W. Haycock, steel union official in Utah and Nevada, testified on the House side in support of the Simpson Bill to raise tariffs.

COMMUNISTS IN MINE-MILL: Mine-Mill is trying to get the Justice Dept. to drop the indictment against international representative Clinton E. Jencks, accused of signing a false non-Communist oath. Leaders fear disclosures which might come out of a trial. A new unit in the Justice Dept. is taking another look at suspected affidavits, including that of secretary-treasurer Maurice E. Travis, former Communist, who still believes in communism. The Mine-Mill delegation that visited the Justice Dept. in Jencks' behalf included Washington legislative representative Herman Clott. A Brooklyn school teacher included Clott in a list of persons whom she knew as Communists in Washington from 1943 to 1946.

THIS AND THAT: A new directory of labor unions is available from the U. S. Government Printing Office for 35 c. It puts union membership near 17-million. Mine-Mill does not disclose its membership, but claims 300 locals. . . . Even a no-raiding agreement as a first step toward unification will be difficult for AFL and CIO to achieve. . . . Mine-Mill joins the United Mine Workers in opposing Thomas Lyon's appointment as Director of U. S. Bureau of Mines. . . . Both AFL and CIO are streamlining their organizing machinery to step up membership drives. Too many organizers have been sitting behind desks giving "service" to new locals.

CHUQUICAMATA where the 30,000-ton sulphide plant costing $120-million was inaugurated on April 7.

Chuqui Inaugurates New Plant

THE PRESIDENT OF CHILE, General Carlos Ibañez, visited Chuquicamata on April 7, 1953, for the inauguration ceremonies of Chile Exploration Co.'s new sulphide plant, accompanied by the Minister of Finance and the Minister of Labor.

The oxide mine has been in continuous operation since 1915. Prior to the inauguration of the sulphide plant 362,911,000 tons of oxide ore and 160,557,000 tons of waste material were taken out of the open pit up to Sept. 30, 1952. Total copper produced during that period was 10,212,000,000 lb.

Mine production will be 30,000 tons of oxide, 30,000 tons of sulphide and 45,000 tons of waste, or 105,000 tons daily, which should give a total copper production of 500,000,000 lb. yearly. Dimensions of the open pit at present are: 8,850 ft. long; 3,540 ft. wide, 980 ft. deep.

The general design of the $120-million sulphide plant was planned by Wilbur Jurden, chief engineer, Anaconda Copper Mining Co., who had to overcome several problems not previously encountered in this type of construction. Stewart Carpenter is resident engineer for Mr. Jurden.

The crushing plant is designed to handle 30,000 tons of ore per day, which will be taken to the primary crusher in trains made up of 8 or more 90-ton side-dump railroad cars.

Interesting problems were encountered in the design and location of the concentrator, which was finally based on the treatment of sulphide ore crushed to about ¾ in. or 1 in. The location selected had a natural ground slope of 7%.

Tailings disposal was designed to meet the requirements of the Chilean Government concession, granted for this purpose, which involved special plant necessary to avoid contamination of the adjacent Loa river.

Present smelter facilities are as follows:

Bedding plant consisting of 3 beds each 50x360 ft., 11,000 tons capacity.

Four 30x125-ft. reverberatory furnaces, taking 650 tons of charge per day per furnace; balloon flue and 300 ft. stack.

Waste heat recovery plant consisting of 8 waste-heat boilers; three turbogenerators of 7500 kw. each, operating at 725° and 400 psig.

Four 13x30-ft. Pierce-Smith converters.

Two 300-ft. stacks.

Two holding furnaces with 26 anode molds in either of two sizes or 52 blister molds.

One straightline casting machine.

One holding furnace, tilting type, endless chain-casting section.

Quantities of materials used in the new sulphide plant are:

Excavation	1,900,000 cu. meters
Backfill	1,900,000 cu. meters
Reinforced concrete	115,000 cu. meters
Steel for construction and warehouses	35,000 tons
Steel for concrete and wire mesh	7,500 tons
Brick and mortar	6,350 tons
Railroad and accessories (30 km.)	3,350 tons
Railroad cars and locomotives	6,700 tons
Pipe for air, water, reagents, concentrates and tailings	20,000 tons
Electrical equipment, control and cable	12,150 tons

Mechanical equipment.....	40,450 tons
Construction equipment, tools, etc.....	2,700 tons
Total material used....	134,200 tons

Besides this tonnage about 7,500,000 bd. ft. of lumber was used, 3,500 tons of nails, form tie material, and 50,000 tons of cement.

The sulphide plant has a capacity of approximately 30,000 tons of sulphide ore per day. The existing oxide crushing plant has a continuous capacity of 50,000 tons of oxide ore per day. At present, the sulphide and oxide plants are supplied daily with ore crushed at the oxide crushing plant which is being operated at more than its capacity for a short period. This bottleneck will be removed when the new sulphide crushing plant, now nearing completion, is put in operation.

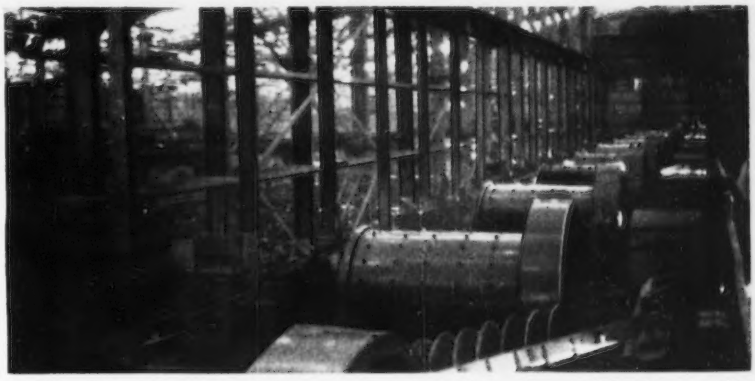
The electrical system is based on the company's power plant at Tocopilla, about 90 miles from the mine on the coast. The original plant was built in 1914 and has been constantly improved and expanded. A waste-heat power plant has been built adjacent to the smelter to take advantage of the 2500° gases from the reverberatory furnaces.

Water supply for the old and new plants also presented serious problems because Chuquicamata is located on the barren Atacama desert. Four pipe lines from sources near the Bolivian frontier supply industrial and household water, but extensive construction work had to be done, including building of dam, syphons, settling basin, de-aeration plant, etc.

General construction of the sulphide plant was undertaken by Foley Brothers. Work started in 1949.

Foley Brothers deserves special mention for meeting many labor problems that arose during construction. Carl L. Swenson, president of Foley Brothers, arrived from New York for the inauguration. Dan Young, general manager of Foley Hermanos, Ltda., is in charge of construction. Mr. Young had previously been in charge of mechanization of open-pit coal mining in India and is well known both in the United States and England.

GENERAL IBANEZ, president of Chile, was among visitors at inauguration.



GRINDING SECTION of the new concentrator is made up of 12 Marcy mills.

FOUNDATIONS for smelter furnaces and reverb stack during construction.

Committee Studies Iron Ore Taxation in Minnesota

MATTERS RELATING to the taxation of iron ore are being studied by an interim committee of the Minnesota legislature, composed of eight members each of the house and the senate. The effect of the following factors is being investigated.

The quality and extent of Minnesota iron reserves and those in other parts of the world.

Cost of mining and developing Minnesota iron ores and those in other parts of the world.

The advisability of using the Lake Erie price as a tax base.

The impact of national defense considerations and the possible construction of the St. Lawrence waterway upon the Minnesota iron ore industry.

The committee will report to the legislature to assist it in forming a fair policy for taxing iron ore.

State Taxes are Four

Iron ore in Minnesota is subject to four state taxes, according to the 1951-52 biennial report of the Minnesota department of taxation. These are: an ad valorem tax, an occupation tax, a royalty tax, and a tax on taconite and iron sulphide deposits.

The ad valorem tax is levied upon the mined and unmined ore: mined

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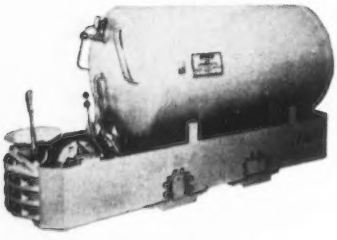

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This Month in Mining *(Continued)*

ore or stockpiled tonnage being valued as a part of personal property; and unmined ore as a part of real property. The value of the ore reserve in each property is based upon the tonnage of unmined ore as reported by the University of Minnesota School of Mines.

The occupation tax provides that anyone who produces iron ore—or other ores—in Minnesota must pay to the state a tax of a specified percentage of the valuation of the ore (now 11%), less certain credits as defined by the law, such as mining, administration and development costs, royalties and a percentage of the ad valorem tax. An additional tax of 1% of the valuation used in computing the 11% tax is levied and paid to the veterans' compensation fund. This 1% tax is effective for the ten-year period from Jan. 1, 1949, to Dec. 31, 1958.

The royalty tax is levied and collected upon all royalties received during each calendar year for permission to explore, mine, take out and remove ore from land in Minnesota. This tax is 11%, plus an additional 1% for the veterans' compensation fund during the same 10-year period as applied to the occupation tax.

Taconite and iron sulphides are taxed at specified rates per ton, depending upon the iron content. For the years 1949, 1950 and 1951, the taconite tax has been imposed on one operation in Minnesota, namely, the Erie Mining Co. It is based on the concentrates produced and amounts to 5c. per gross ton of merchantable iron ore concentrates *as produced*, plus one-tenth of 1c. per gross ton for each 1% that the iron content of such product exceeds 55% when dried at 212 deg. F. This tax is in addition to the occupation and royalty taxes; but, briefly stated, is in lieu of all other taxes upon such taconite and iron sulphides and the machinery and buildings used in their mining and beneficiation.

State, county and local units of government received more than $82-million from these four taxes in 1950 and 1951. In the latter year alone these taxes contributed nearly $45½-million to Minnesota government units. The largest contributor was the occupation tax, followed by the ad valorem tax, with the royalty and taconite taxes next. The tax on taconite brought in $886 in 1949, $3650 in 1950 and $5912 in 1951. It will be interesting to note the increases in the taconite tax during the next few years as present plans for taconite concentration develop. These gains may follow a pattern similar to that of wash ore, after the first washing plant was built in 1910.

The Mesabi range, of course, has the largest reserves and the largest production. It also has the immense reserves of taconite that are now evoking the investment of hundreds of millions of dollars. The Mesabi made its first shipment in 1892; the Vermilion in 1884 and the Cuyuna in 1911.

Reserves of the Mesabi in 1943 were 1,043,804,391 tons. The year 1944 was the last in which they exceeded one billion tons. They declined steadily until, in 1949, they were 900,959,665 tons. In 1950 they had increased to 912,226,039 tons. The decline was resumed in 1951 and 1952 with tonnages of 893,007,833 and 854,280,596 respectively. Valuations have been more erratic. They were $145,103,721 in 1943; $112,019,599 in 1947; $123,615,636 in 1948; $119,268,179 in 1949; $142,306,395 in 1950; $132,019,408 in 1951 and $149,687,789 in 1952.

Battelle Develops Process for Non-Magnetic Taconite

A process known as the "reduction-oxidation process" for treating non-magnetic taconites was described at the Blast-Furnace, Coke-Oven, and Raw Materials Conference of the A.I.M.E. recently by F. M. Stephens, Jr., B. Langston, and A. C. Richardson, technologists at Battelle Institute, Columbus, Ohio.

The three authors point out that one of the existing methods for processing non-magnetic taconite ores involves conversion to magnetic form by heating, followed by magnetic separation. This method has always been attractive but the high cost of furnishing heat has been prohibitive. The new process cuts down the amount of initial heat required and makes it possible to recover and reuse it. For reduction a gaseous fuel containing hydrogen and/or carbon monoxide has been found most suitable.

The technical feasability of the reduction-plus-oxidation process has been shown in a laboratory pilot plant, with a 2-ft. diameter shaft furnace capable of taking in ore at a rate of up to 600 lb. per hr. Studies have also shown that the process is applicable to a wide variety of taconites, including mixtures of hematite, magnetite, and the carbonate siderite.

According to the research men, the high recovery of iron units, 92 to 96%, in magnetic form from ores treated by the reduction-oxidation process, plus the increased grindability of the processed ore, indicate that the process will be economically attractive. Savings in grinding costs may more than offset the cost of treating the ore by the new process.

Development of this process was part of a research project on development of concentrating processes for Mesabi taconites that has been spon-

sored at Battelle for ten years by ten companies comprising Armco, Cleveland-Cliffs, M. A. Hanna, Inland Steel, Jones & Laughlin, Oglebay Norton, Oiver Iron, Pickands Mather, Republic Steel and Snyder Mining.

AEC Opens New Office

ATOMIC ENERGY COMMISSION'S Division of Raw Materials has opened a new exploration sub-office in Ishpeming, Mich. L. P. Barrett, formerly geological consultant with Jones & Laughlin Steel Corporation, will direct its activities on a part-time basis. Mr. Barrett says "One of the main objectives in establishing the office at this location is to stimulate interest in exploration for uranium deposits in northern Michigan, Wisconsin and Minnesota."

Diesels Take Over

FOR THE FIRST TIME since ore was hoisted at the outset (70 years ago) in the Iron River district, Michigan, on the Menominee Range, there are no steam locomotives hauling iron ore. All road engines assigned by the C. & N. W. and Milwaukee railroads to the Menominee range this season are diesel-powered. One four-unit diesel locomotive has hauled 140 loaded ore cars out of the Stambaugh yards and, at Iron Mountain 23 cars more were added, making the total load 11,400 tons. Running time from Stambaugh to the Escanaba docks was 10 hours. Steam locomotives are used now only for yard and mine switching.

VISITORS TO the Gran Sabana try their hand at panning—diamonds or gold may be in the pay dirt.

Venezula Bonanza

VENEZUELA RECENTLY opened up one of the richest and least explored areas of the world—the vast 14,000-sq. mi. Gran Sabana, reported to be rich in gold, diamonds, and other minerals. A weekly three-hour flight from Caracas takes explorers or tourists to the interior. Only a handful of white men have ever set foot in this country. This remote land has been termed the "Lost World" by Sir Conan-Doyle in fiction.

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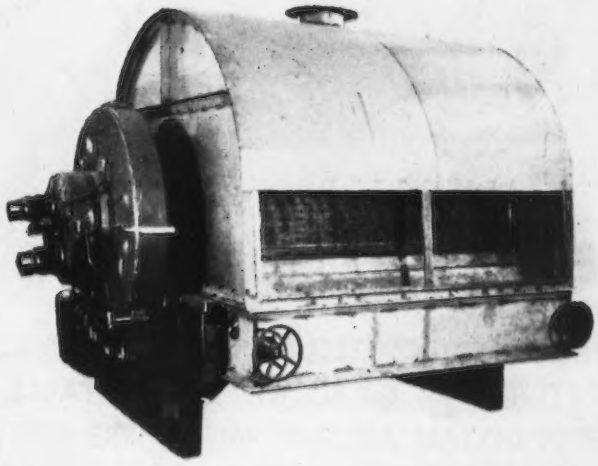

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How Mining Leaders View The Sliding-Scale Tariff

WIDELY DIVERGENT OPINIONS exist in the mining industry today as to whether or not the proposed sliding scale tariff as mentioned in the House Simpson Bill will result in metal-price stability. Here are some recently announced views:

N. W. Rice, chairman of the board, United States Smelting Refining & Mining Co.:

"We believe that the sliding scale tax is fully justified, not as a means of shutting out foreign metal but as a protection against the dumping in our market of metal produced abroad by labor paid less than, and in many cases but a fraction of, our own. From the point of view of those who fabricate these metals two things are vital: first, an adequate supply (whether domestic or foreign is not a matter of concern to them) and second, a reasonably stable price so that forward buying can be intelligently scheduled. The actual price level is less important so long as it is not excessive.

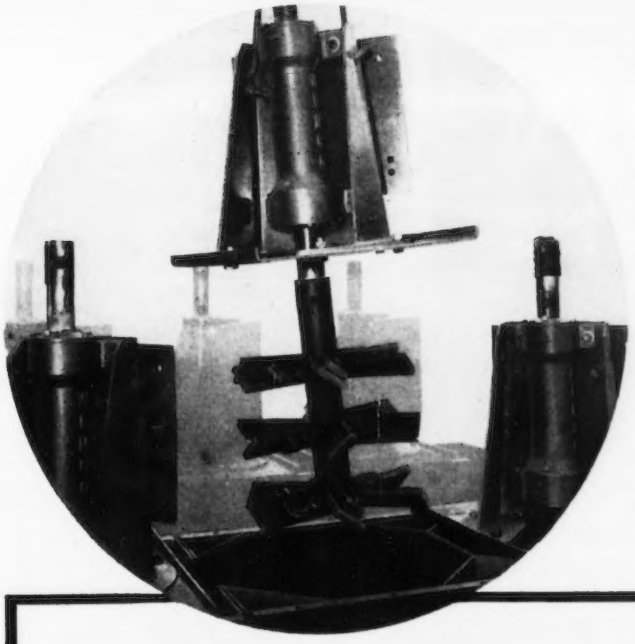
"We believe that the base price of 15½c. per pound set in the proposed legislation will tend to stabilize the price in the domestic market at around that figure, and we believe that such a price would be acceptable to the fabricators and other consumers. When, as a result of the tax, the domestic price has stabilized, it will tend to fluctuate about the level needed to maintain a healthy domestic mining industry. If it goes above that level the tax will disappear, imports will be encouraged and will tend to bring prices back to the desired level."

Robert P. Koenig, president of Cerro dePasco Corp.:

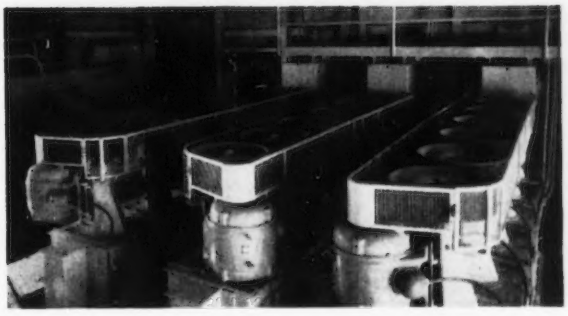
The sliding scale tariff for lead and zinc as contained in the House Simpson Bill "is undesirable, as it interferes with the establishment of prices by achieving a balance between supply and demand, and cannot but result in even more violent fluctuations of prices damaging not only to producers, but to consumers as well."

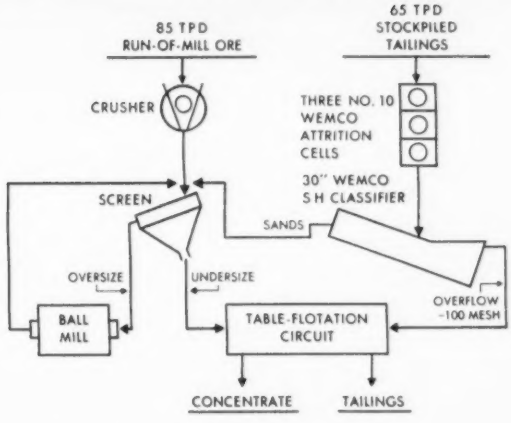
Simon D. Strauss, vice president of the American Smelting & Refining Co.:

"If the domestic mining industry were capable of supplying all the needs of domestic consumers, the attempt to retreat behind this Chinese wall of high tariffs might well prove feasible. But in the period since the end of World War II—which is now over seven years—domestic mine production of zinc has consistently been less than 70% of U. S. consumption of primary zinc. During this period the price of zinc has been erratic but for the most part it has been high in relation to pre-war levels. In fact, zinc has done better than the average of wholesale commodity prices of the Bureau of Labor Statistics. . . ."



40% increased flotation recovery WITH WEMCO ATTRITION MACHINES





RETREATMENT OF STOCKPILED TAILINGS

On this tungsten application note that use of Wemco Attrition Machines makes it possible to feed former tailings into the same flotation circuit as new run-of-mine ore, resulting in considerable added profit to this producer in terms of greater units of tungsten recovered.

Increased recoveries of critical tungsten minerals are now being made from materials rejected as tailings by various milling processes previously used at a Nevada tungsten mine (name on request).

By using Wemco Attrition Machines together with flotation, it is now possible to recover 92% of the tungsten values in this former reject material. Before addition of the attrition machines, flotation alone recovered only 64% of the tungsten. The greatly increased recovery after attritioning is due to removal of a stubborn oxide coating on the mineral particle surfaces, caused by weathering of the stockpiled material.

75% increased mill tonnage was made possible with the installation of Wemco Attrition Machines to treat 65 tons per day of former rejects.

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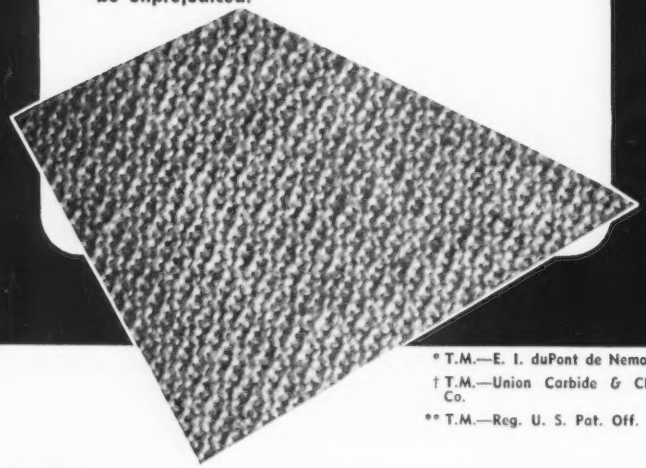

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Southwestern Miners Seek Tariff

MINING INDUSTRY SPOKESMEN from nine Southwestern states presented a six-point program for the industry at a Phoenix, Ariz., hearing conducted by a mining subgroup of the House Committee on Small Business.

Paramount was the plea of lead-zinc representatives. Unless a flexible tariff is imposed immediately, mines now closing down because of inability to buck cheaply produced foreign imports face ruin.

Other recommendations included:

Creation of a department of mineral resources with cabinet rank which would include all federal agencies dealing with mines or mining;

Defeat in Congress of bills to amend the public land laws;

Defeat of measures proposing a premium price or subsidy on metals;

Changes in tax laws including income and capital gains levies to attract venture capital; exemption of newly developed mines from taxes for a three-year period; and enactment of mine laws similar to those of Canada.

Witnesses to the meeting came from Arizona, Nevada, California, Utah, New Mexico, Texas, Arkansas, Oklahoma, and Kansas.

In appealing for assistance in the lead-zinc field, witnesses testified that more than 4,000 miners—including 1,000 in Arizona—have been idled by closing of the lead-zinc operations.

In one Utah district, they claimed, 650 or 900 lead-zinc workers have been laid off.

Arizona's payroll loss was set as $4-million annually. Seventy-five mines were reported closed in the Tri-State area of Arkansas, Oklahoma, Kansas where 2,000 miners are out of work.

No immediate floor price was seen needed for copper which is continuing economically sound, but enactment of a sliding scale import tax on foreign lead and zinc in the amount of 1c. per lb. for each cent per lb. below base price was recommended.

Miners said such legislation would provide for an accumulation of a stock pile of a three-year supply of strategic metals.

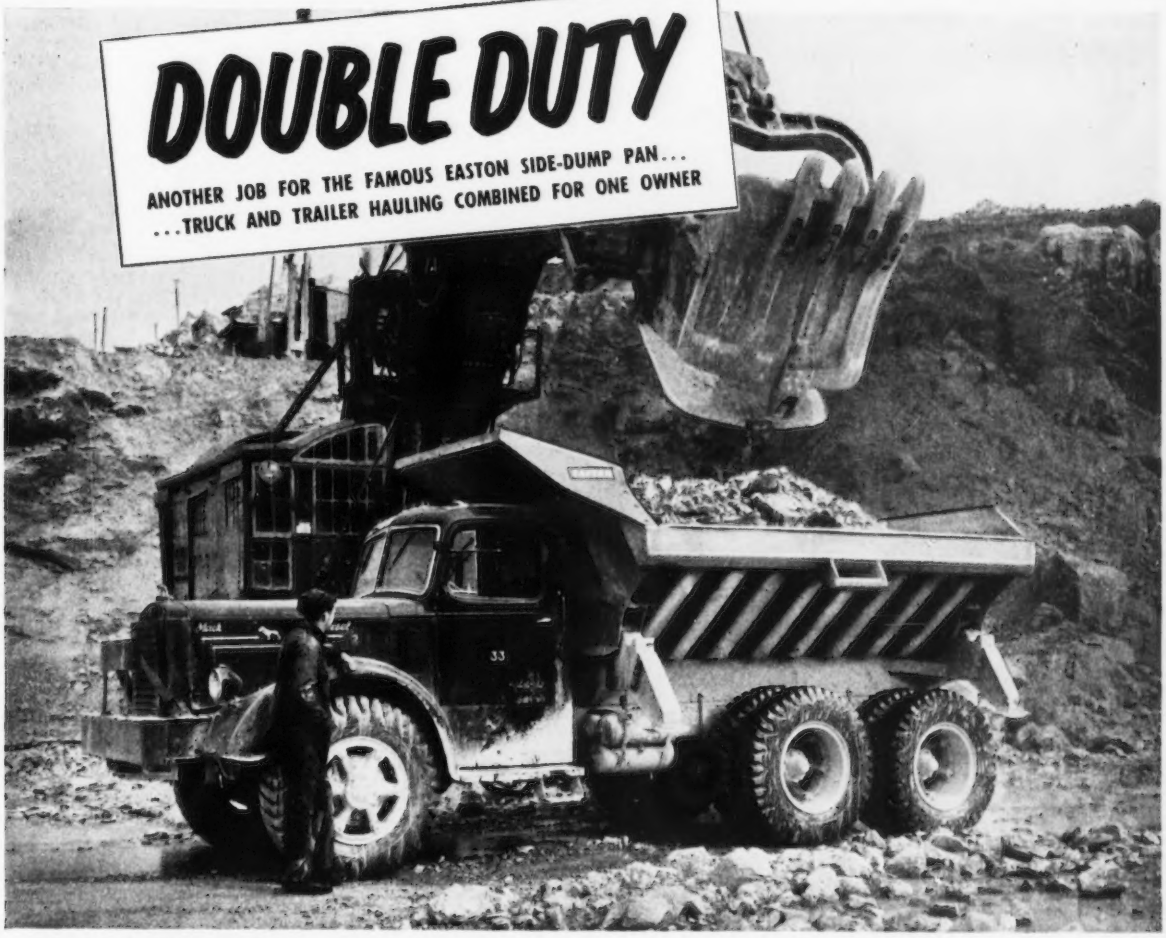
"We believe it to be a very dangerous policy to place our country in a position of dependence upon unreliable foreign sources of metal for our defense and industrial needs. The only safeguard against this dependence is for our government to accumulate stockpiles of lead and zinc from present world surplus and to build up our domestic lead and zinc mines as rapidly as possible," spokesmen for the Arizona Small Mine Owners Assn., which arranged the meeting, said.

Citing that farmers get better treatment than miners, the Tombstone Council of the association summed it up this way:

"We believe that, in our democratic

DOUBLE DUTY

ANOTHER JOB FOR THE FAMOUS EASTON SIDE-DUMP PAN...
...TRUCK AND TRAILER HAULING COMBINED FOR ONE OWNER



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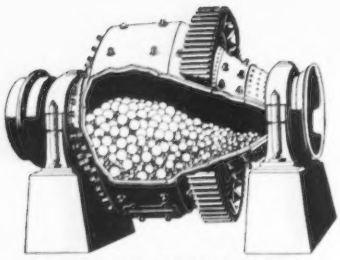
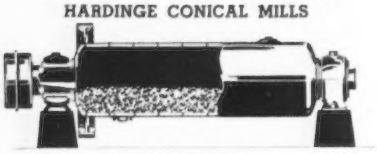
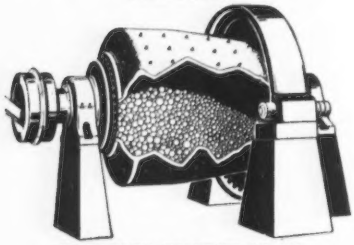


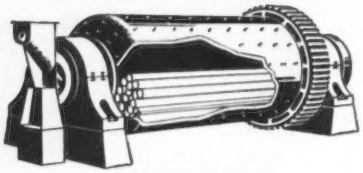
HARDINGE CONICAL MILLS



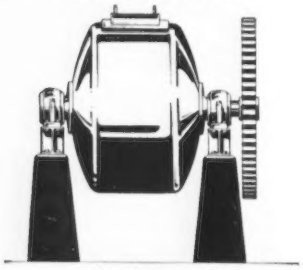
TUBE MILLS



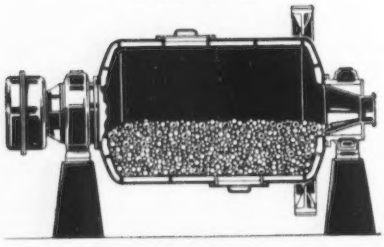
HARDINGE TRICONE MILLS



HARDINGE ROD MILLS



BATCH MILLS



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This Month in Mining *(Continued)*

concept of equal rights and privileges for all, our small mining industry is entitled to receive, and should be granted by the federal government, the same consideration, the same production incentives by price supports and subsidies and the same tariff protection against the importation of cheap foreign metal as have been and are now being given to our agricultural industry.

"The cost of establishing and maintaining a strong dependable mining industry will be insignificant as compared to the cost of our foreign aid and farm support programs," they noted.

Other speakers remarked, "We believe it is unfair and improper for our government to sponsor and build up the economy of foreign countries at the expense of and to the neglect of our own."

Arizona miners also recommended that the government establish in the Globe (Gila county) area a custom mill for the processing of asbestos.

IN THE U.S.

ALABAMA

★**Woodward Iron Co.** has just completed the new heavy media plant at the Pyne Mountain ore mill. It is part of the company's $18-million expansion and modernization program which has been under way during the past five years. The drift through the fault at Pyne Mountain mine is about completed which will increase ore production. No. 4 blast furnace is in operation which means that the company can take out a furnace for repairs without hurting production of pig iron. The 30 new coke furnaces, together with auxiliary equipment, have placed the company in a position to meet present demands.

★**All red ore at the mines** of the Tennessee Coal & Iron Division of U. S. Steel Corp. is now loaded with Joy loaders. The company has completed the change-over. The company now has four operating and one spare section and has eight shifts of 9-man crews and a repair crew on one shift. Each day one operating crew works in the spare section while its equipment is being worked on by the maintenance crew. The program is to mine four days; then the next day the equipment is turned over to the maintenance crew. Thus the spare section gets a new crew each shift. The same procedure is being followed in the coal mines.

TCI's experiment in operating diesel-electric shuttle cars in the limestone mine has proved very successful. The scrubbers and cleaners on the motors are very efficient. The cars are operating on grades up to 18%.

ARIZONA

★**Arizona's state mine inspector** does not have the power to confiscate dangerous overage explosives, the attorney general of Arizona has stated.

The opinion said that the mine inspector's office has not adopted rules under legislation which give that office the responsibility for regulating explosives. Nor has the mine inspector's office set down a penalty for violation of the laws dealing with explosives.

State officials indicated steps would be taken to bring the matter to legislative attention and effect a law providing regulation.

★**Ben Coil, assistant general manager,** says mining at the Castle Dome Copper Co. (Gila County), will end late this year. The plant will be moved to the near-by Sleeping Beauty mine.

★**Vanadium Corp.** has signed agreements for mining of psilomelane manganese from 19 claims in Coconino County, 15 miles west of Heber. Output will be shipped to Wenden, site of the government's purchasing and stockpiling depot. Vanadium took over claims formerly held by Johnnie Patrick and Paul Cooper.

★**Boriana mine,** one of the largest producers of tungsten in the nation, has resumed its operations in Mohave County and expects to double its present 25-ton per day output. Consideration is being given to construction of a sink float for utilization of old tailings as well as for new ore. Boriana placers are idle pending building of a roasting plant to include magnetic separation. The creek gravels carry about 14% tungsten and 2½% chalcopyrite copper.

★**Some of Mohave County's old gold workings** are being reconsidered in anticipation of a possible price rise and considerable test work is being conducted in the Oatman and Kingman areas.

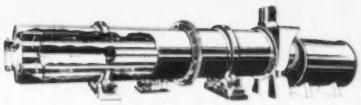
★**Preliminary reports** of the three-month AEC survey in Mohave County indicate four Cerbat Mountain mines have uranium ore in commercial quantities, but the extraction and milling processes are complicated, with a different method required for each.

Citing some figures on what the mining industry means to Arizona, Frank J. Tuck, statistical engineer for the state department of minerals and resources, has noted that mining supports 94,000 of the state's 700,000 population and provides a fourth of the annual $1-billion economy.

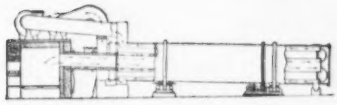
Tuck, who issues regular statistical statements for the benefit of the industry, notes that it's been 40 years since any bonanza ore has been discovered in Arizona, and that mines today are operating on ore that would have been thought worthless 20 years ago.

Today's mines are made, not found, he says. It took more than $200-million for exploration of the low grade

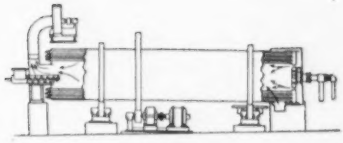
Rotary Dryers, Kilns, Coolers for every Application



DOUBLE-SHELL SEMI-DIRECT HEAT DRYERS

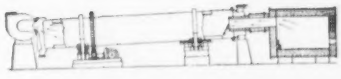


DOUBLE-SHELL INDIRECT-HEAT DRYERS

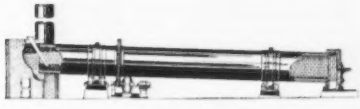


STEAM-TUBE INDIRECT-HEAT DRYERS

SINGLE-SHELL COUNTERFLOW DIRECT-HEAT DRYERS



SINGLE-SHELL DIRECT HEAT PARALLEL-FLOW DRYERS



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Bulletin 16-D-1

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Arizona *(Continued)*

ores and development of methods and handling them to build up that Arizona supply.

To produce Arizona's 393,350 tons of copper ore last year, the mines handled almost 40-million tons of copper ore and in some places almost a ton of waste overburden for every ton of ore.

CALIFORNIA

★**Bethlehem Steel Corp.** has denied reports that it acquired a lease of four 2-acre iron claims north of Lake Bowman in Nevada County (*E&MJ* April).

★**Idaho-Maryland Mines Corp.** has ended leasing sections of its Idaho and New Brunswick gold mines and is operating them on a company basis.

★**A gold dredger** designed to handle about 4-million cu. yd. of gold-bearing gravel annually will be put into operation in late July by the Yuba Consolidated Gold Fields. It's to be launched at Hammonton, in the Yuba River area east of Marysville. The dredge can dig 107 ft. below water level.

★**After four months** of successful surface development and diamond drill exploration work, the California Tungsten Corp. has taken up its purchase option on the Linka Tungsten Mine in Lander County. The company started sinking a three compartment shaft, and plans to build a concentrating mill with a capacity of 100 tons daily.

Edward G. Frawley of Salt Lake City is the president and Roy A. Hardy of Reno is consulting engineer.

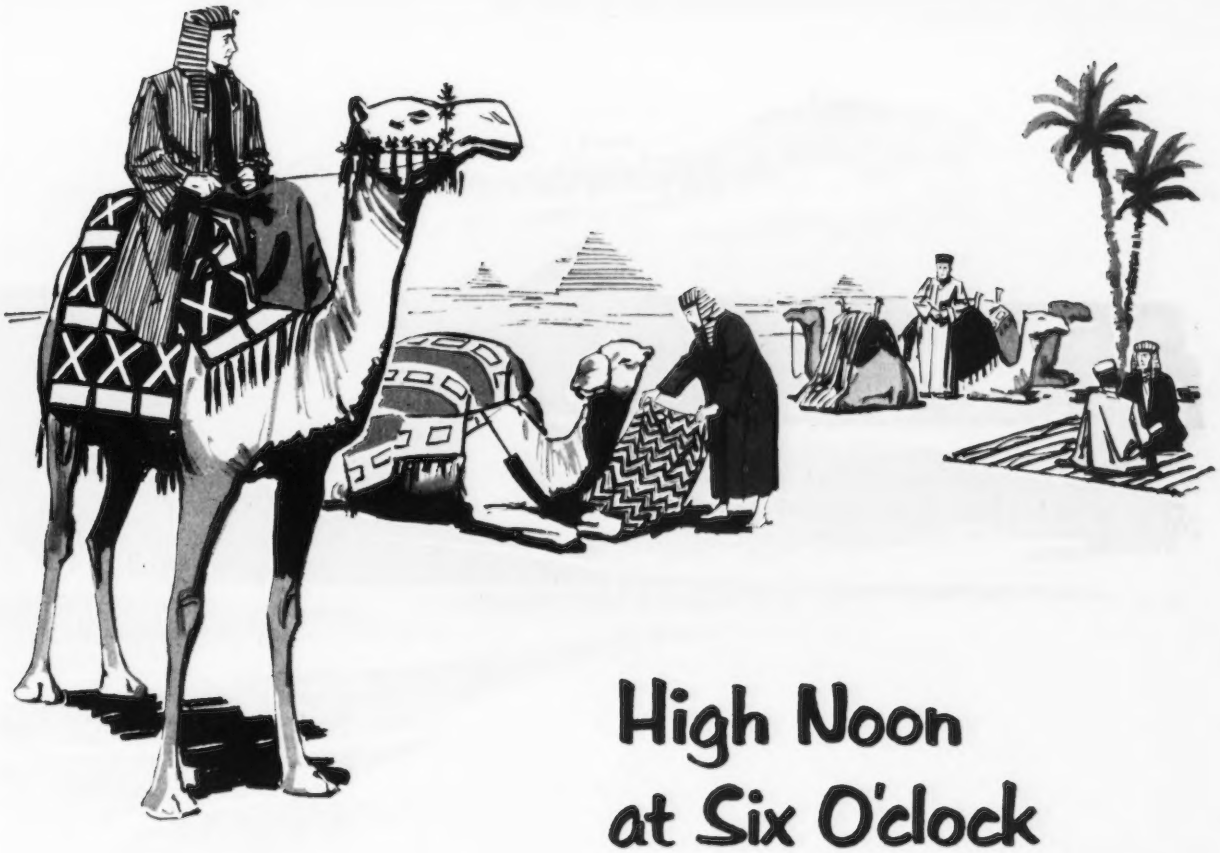
The Linka mining property of four claims is located about 20 mi. east of Austin.

COLORADO

★**Cripple Creek reports good news** from mines of the district. The Golden Cycle Corp. recently made a small shipment of high grade ore from the 30 level Bobtail stope on the Ajax which was settled at the mill for $4,504.85 of gold to the ton. This small batch of ore, 1,594 pounds, was sacked from a hot spot in the eleven-chute stope on 30. More of the same rich ore should be sent to the mill from the 30 level stope as well as from the cut-out work being done on 3100.

★**First lot of coarse ore** shipped by the Gold Sovereign Leasing Co. from the 8 level of the Cresson mine at Cripple Creek has been sent to the mill. Two chutes have been put in under the rich strike.

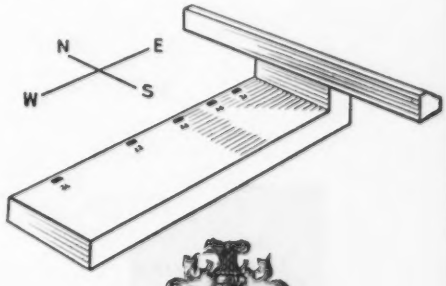
★**Some better grade ore** has been encountered in a raise being driven from the 10 level of the Gold King by the Cripple Creek Mining & Milling Co.



High Noon at Six O'clock

. . . and time for the Siesta

Man's constant striving to keep track of time produced countless varieties of shadow-clocks of which the familiar garden sun-dial, being only a thousand years old, is the newest. Three thousand years ago, the Egyptians used a bar-type shadow-clock placed with the crossbar at the east end of the metered slab in the morning and reversed at noon. It measured the daylight hours in two groups of six, noon being the "sixth hour." A thousand years later, the Romans were still calling it the sixth hour—in Latin, "Sexta Hora"—which the Moors and Spaniards shortened to "Siesta," still meaning noon-hour and rest. Today, time is so valuable that we measure it with meticulous accuracy, expend it sparingly, save it wherever possible. In the drilling business, a good way to save time is with Truco Diamond Bits. Their irresistible cutting power penetrates any formation, swiftly, accurately, thriftily, dependably. They are used profitably in every phase of drilling. Have you looked in our catalog lately?



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Colorado *(Continued)*

★**Climax Molybdenum Co.** reports it earned $6,071,519 last year, almost $2-million less than in 1951. Arthur H. Bunker said the decreased earnings were due to construction needed for ore output to fulfill government contracts.

★**Gold and silver receipts** from mines and mills at the Denver U.S. Mint were in heavier volume in March, mint officials report. Receipts of gold for the month totaled 94,943 oz. worth $3,322,976 compared with 59,134 oz. valued at $2,069,716 in March, 1952. Silver receipts came to 308,573 oz. worth $279,128 last month compared with 158,300 oz. worth $143,237 in March, 1952.

★**Mining and milling equipment** went through Gunnison recently on the way to Crested Butte for the Keystone Mine of the American Smelting & Refining Co. Part of the equipment is for the 200-ton mill that will be built at the Keystone mine. It comes from AS&R's Mike Horse mine in Montana.

★**Increasing interest in thorium,** the rare earths and complex uranium ores in the Colorado-Utah Plateau area is indicated by the filing of incorporation papers for the Rare Earth Mining Co. with headquarters at Placerville, near Telluride.

★**Exploration for uranium** bearing deposits at the Consolidated Caribou mine west of Boulder, Colorado, is at a standstill while the company's affairs are tied up in Federal Court in Denver, Donald M. Nelson, Caribou president, said recently. He has asked the court to authorize reorganization of the company under the federal bankruptcy act.

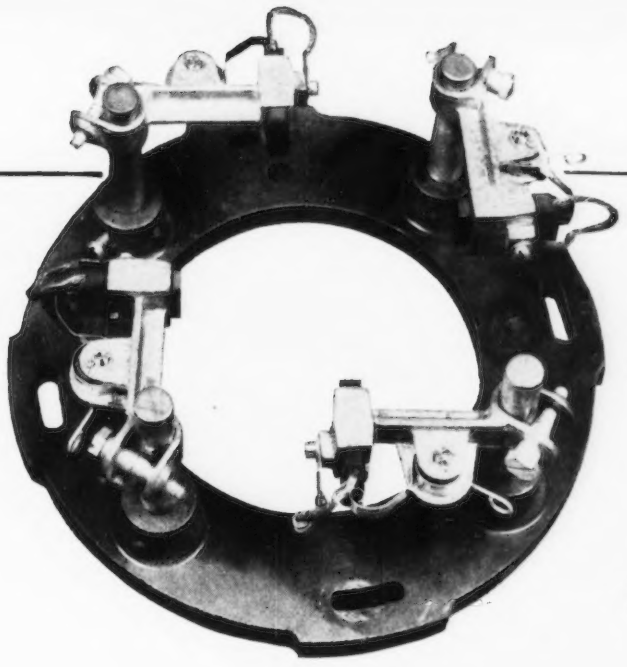
★**A new gold discovery** in the Cripple Creek area is announced by the president of Trail Mines, Inc., W. A. Kyner. The firm has been carrying on development work for several months.

★**Atomic Energy Commission officials** have discounted published reports of a rich uranium strike in the Central City area, west of Denver. *The Denver Post* had reported the uranium strike was made in now exhausted gold mining claims operated by the Realty Co. of Denver.

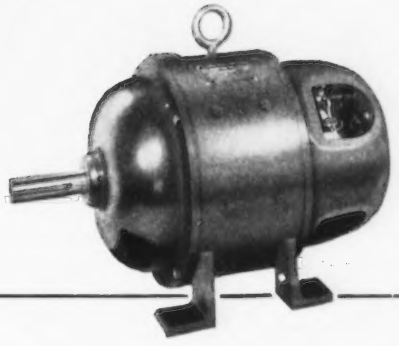
Charles Towle, AEC exploration chief at Denver, said: "The AEC doesn't know anything about any important discovery in that area. We would have been notified if any such discovery had been made."

Towle said AEC field men have scouted the Central City area since 1948 and have found traces of uranium. "But there has definitely been nothing of commercial value," he said.

★**Sprague & Henwood, Inc.** recently was awarded several large contracts for diamond core drilling exploration for uranium ore in the Colorado Plateau area. The contracts total approximately 270,000 ft.



SK DEPENDABILITY



Arcs leave no tracks on this *MELAMINE* ring

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RC 139

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FLORIDA

★**New discoveries and** expanded phosphate operations in Florida have presented some major problems, one of which is the encroachment of mining operations within city limits. One factor against such operations is that mined-out areas are unsightly and grading and filling are necessary before they can be used for other purposes. However, some progress in rectifying this condition, has been made and further study is under way.

Independent Chemical Co., seeking to open deposits within the Bartow city limits, has offered to give the city land which it needs for a highway right of way in exchange for permission to mine other land, which Independent Chemical owns in the city limits.

A further move by the company would leave an artificial lake with graded approaches and overburden would be leveled or used to fill in low spots in nearby areas.

IDAHO

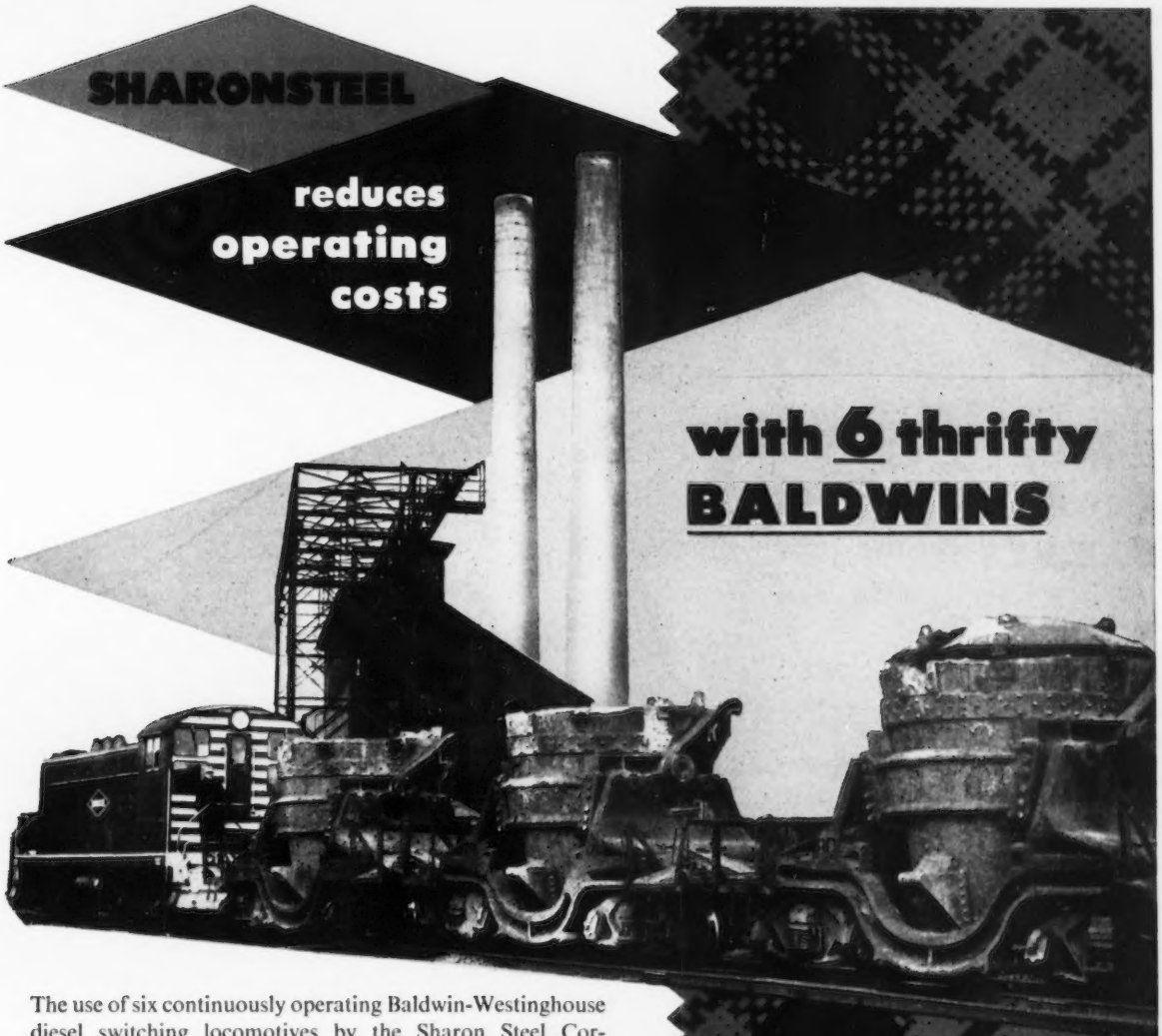
★**A shortage of concentrates** has forced Sullivan Mining Co. to shut down one of the units of its big electrolytic zinc plant near Kellogg, reducing its output by 25%. The closure, which resulted in the lay-off of about 50 men, will mean a loss of about 15,000 tons of special high-grade zinc annually, according to Wallace G. Woolf, superintendent of the plant.

★**Idaho Mining Co.**, having obtained satisfactory results in exploratory drifting on the 300-ft. level, will deepen its shaft 200 ft. to the 500-ft. level this summer, according to Bruce E. Allgaier, Kellogg, secretary treasurer and general manager. The drift work, totaling about 800 ft., exposed two structures sufficiently mineralized to warrant sinking and deeper exploration.

★**Recent surface trenching** and other surface exploration indicates that the fluorspar deposit discovered last summer in the wilds of the Salmon River Canyon in Lemhi County may be the largest yet found in the west. It will take some time to determine full potentiality of the area. Trenching along a large vein near the contact has exposed croppings four to ten ft. wide for about 400 ft. Assays show 94% CaF_2, about 4% SiO, 1% calcite and a trace of iron. The deposit is 20 miles from the end of the nearest road and present access is by pack or boat trip. The property is held under option by Jay Bettles, Dr. F. E. Scott and Jack D. Gay, all of Wallace.

★**Idaho Metals Corp.** is rehabilitating and expects to resume production this year at the 22-claim Werdenhoff property in the Big Creek district of Valley County.

★**Development operations** have been



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Idaho *(Continued)*

resumed by Sun Valley Lead-Silver Mines at its Blue Kitten property in the Warm Springs district of Blaine County, president Ross L. Roundy reports.

★**Sunshine Mining Co.'s Sunshine mine** between Wallace and Kellogg now has the deepest workings in the Coeur d'Alene district. The new 4000-ft. level attained in its No. 5 winze is 1300 ft. below sea level.

★**Polaris Mining Co.** has exposed 94 ft. of new ore in the "New Purim" area which it has undertaken to explore from the 3000-ft. level of its adjoining Silver Summit mine. The ore is silver-copper in siderite gangue and averages about 30 oz. of silver per ton over a width of five ft.

★**Among northern Idaho companies** which have announced plans to resume operations after winter shutdowns are Idaho Goldfields, Inc., which has a lead-silver prospect between Kellogg and Coeur d'Alene, and National Silver-Lead Mining Co., which owns a lead-silver-copper prospect on upper Big Creek in the Coeur d'Alene district.

★**The Atlas project,** first deep-level exploration in the East Silver Belt area of the Coeur d'Alene district, near Mullan, is rapidly nearing its vein objectives on the new 2400-ft. level. Deepening of the shaft from the 800 to the 2400 level was completed in less than a year. Hecla Mining Co., New Jersey Zinc Co. and Newmont Mining Corp. are financing the project, with Atlas Mining Co., owner of the property, an equal partner, and Hecla in charge of the operation.

★**The 100-ton flotation mill** at the Fluorspar Mines, Inc. operation in Lemhi County, near Meyers Cove, was destroyed by fire in mid-April. The loss, estimated at $200,000, is expected to terminate production for at least a year—until further exploration can be done to determine whether or not rebuilding is warranted. The fluorspar operation, a J. R. Simplot enterprise, was Idaho's largest and probably the most remote of its type in the country.

★**Idaho dredge operators** plan to go beyond requirements of the state's new stream dredging code, which becomes effective May 6, to work out a solution for soil disturbance and water problems.

The new law, under which dredging permits are granted with stipulation that operators observe requirements established by the state mining inspector, provides for leveling of soil and tailing ridges or mounds to contour "reasonably the same as it was prior to dredging." Operators must also provide stream channels disturbed by dredging and must install settling ponds to prevent roiling of water downstream.

Baumhoff-Marshall Dredging Co.

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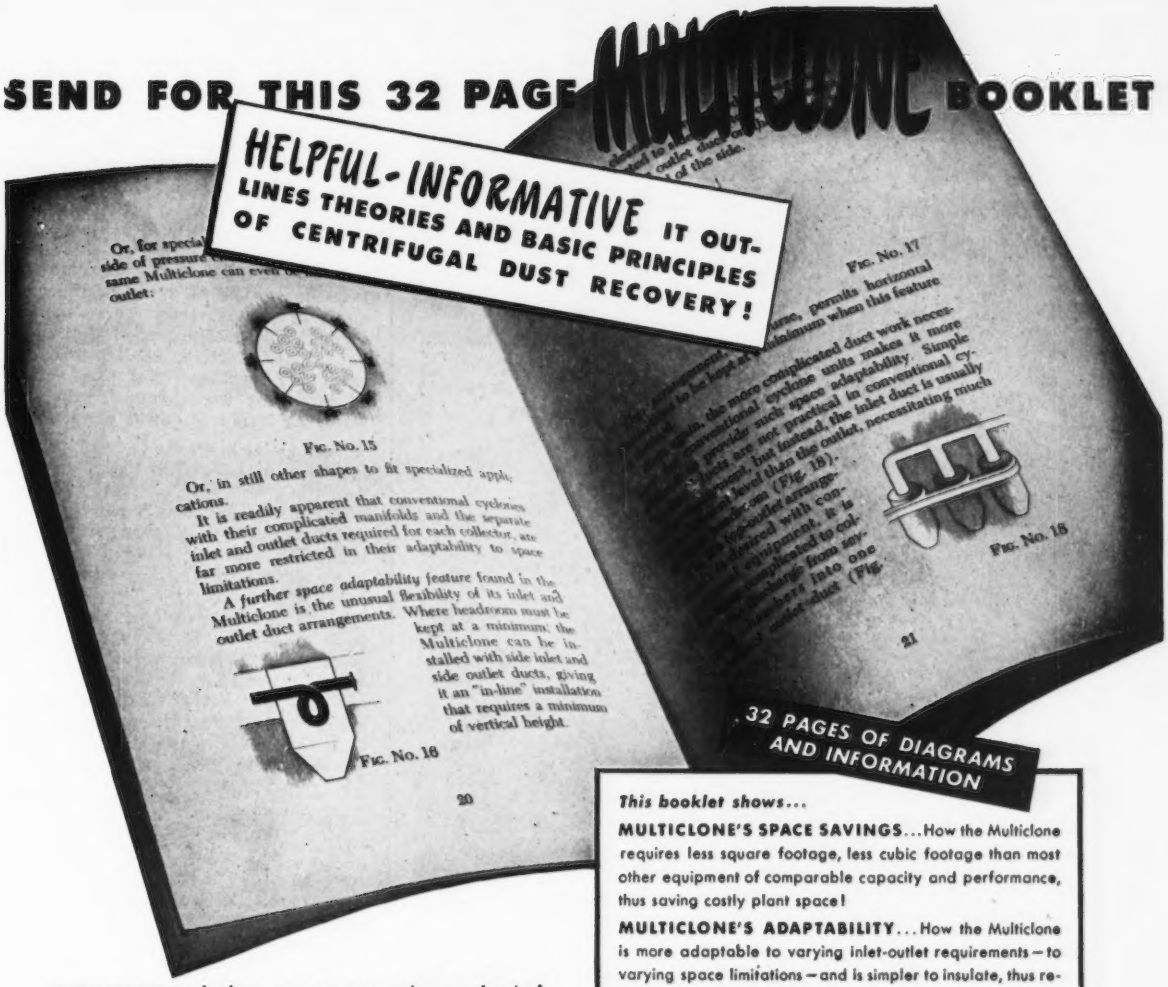
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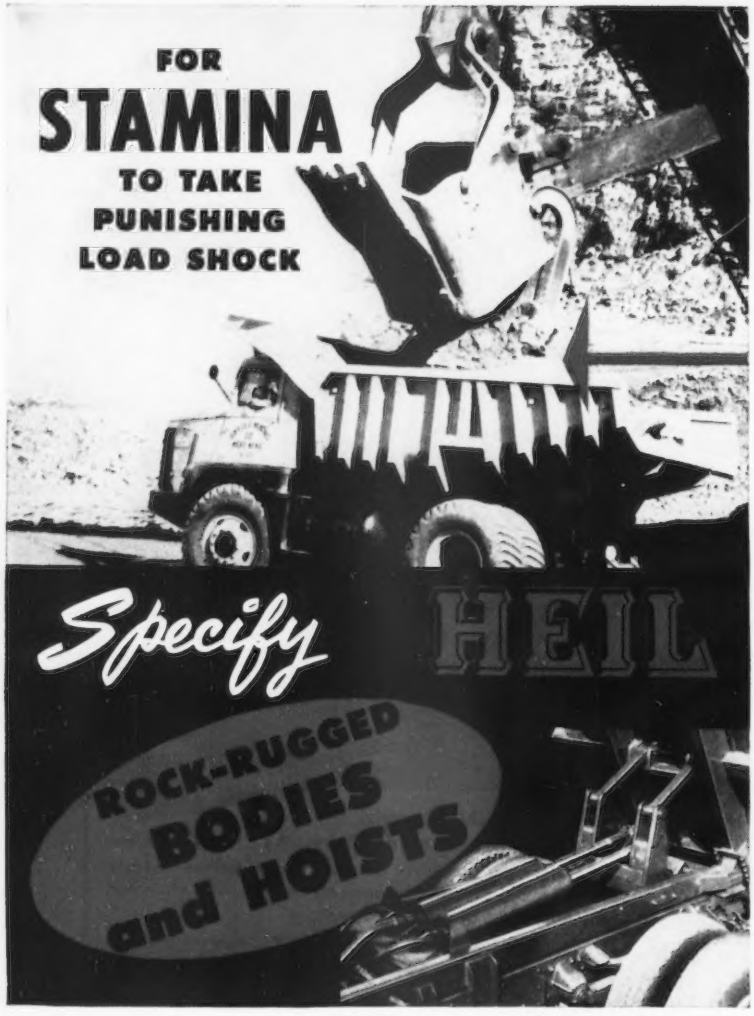

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CONTRACTOR'S BODY

Idaho *(Continued)*

and Idaho-Canadian Dredging Co., the only major dredges now operating in the state, have constructed settling ponds in compliance with the law, according to State Mine Inspector George McDowell. They also are doing leveling work.

In addition, he said, the companies will treat pond water chemically to clear downstream flow as much as possible.

McDowell said operators plan to test the method of applying the calcium hydrate directly as it passes through the dredge, but if that does not prove effective, feeders will be installed at the head of settling ponds to introduce the chemical into the water as it moves downstream.

★**Radioactive monazite** in "rock" form has been discovered in Idaho for the first time.

The disclosure was made by Dr. A. W. Fahrenwald, director of the Idaho Bureau of Mines and Geology, in his annual report delivered in Boise April 6.

Idaho is now producing more than 90% of the U. S. monazite supply from black sands recovered by dredging, but Fahrenwald's announcement was the first report that the radioactive and fissionable material had been found in "immense boulders" on the surface.

★**Deepening of the inclined shaft** at Highland-Surprise Consolidated Mining Co.'s property in the Pine Creek area of the Coeur d'Alene district from the 1450 to the 1900 level has been completed and crosscuts toward the downward projection of the Surprise No. 1 and No. 2 ore bodies are now in progress on both the 1650 and the 1850 levels.

MINNESOTA

★**Continued advance will be witnessed** this year in the development of taconite concentration. Reserve Mining Co., at Babbitt and Beaver Bay, the Erie Mining Co. at Aurora, and U. S. Steel's Oliver Iron Mining Division in its new Pilotac pit and pilot plant north of Mountain Iron are all active. The Pilotac is expected to be shipping concentrates this year at the rate of 500,000 tons per year. Thus Mountain Iron, from whose mine of the same name came the first shipment of iron ore made from the Mesabi range in 1892, will furnish Oliver's first taconite concentrates 61 years later.

Reserve Mining Co. is now producing pellets from taconite concentrates at the rate of 700 tons per day. The pellets, which run 62% in iron, are being shipped all-rail in gondolas to Republic Steel Corp. and Armco Steel Co. steel plants.

★**Pickands, Mather & Co.'s** Rabbit Lake mine, on the Cuyuna range, which is on the site of the former

DOW

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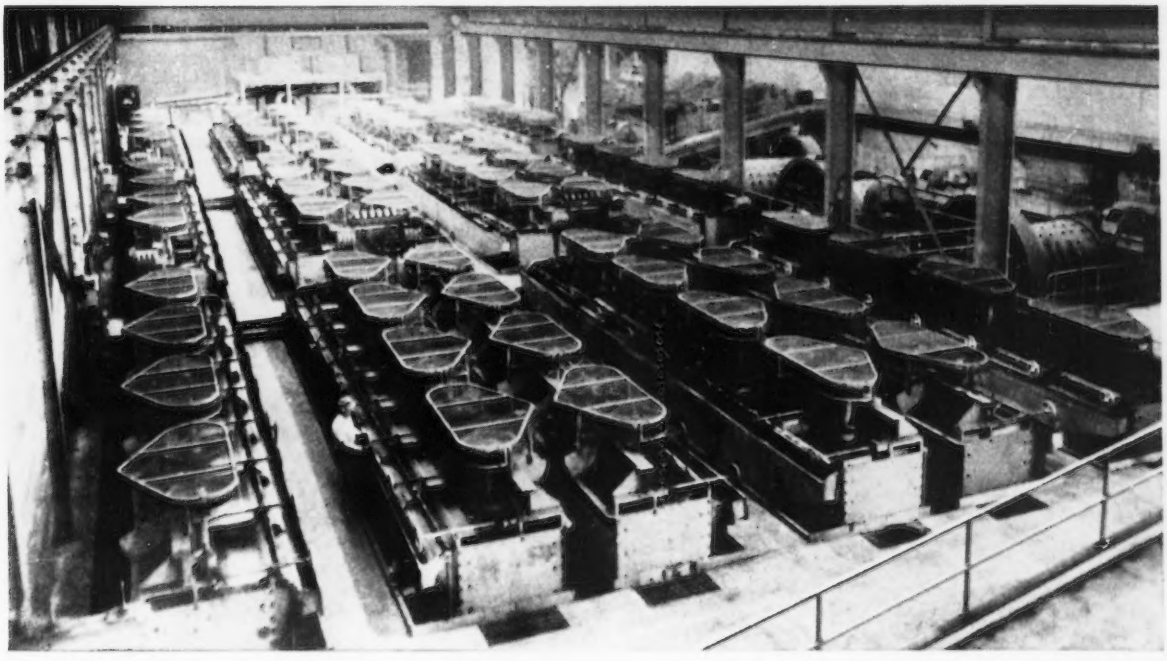

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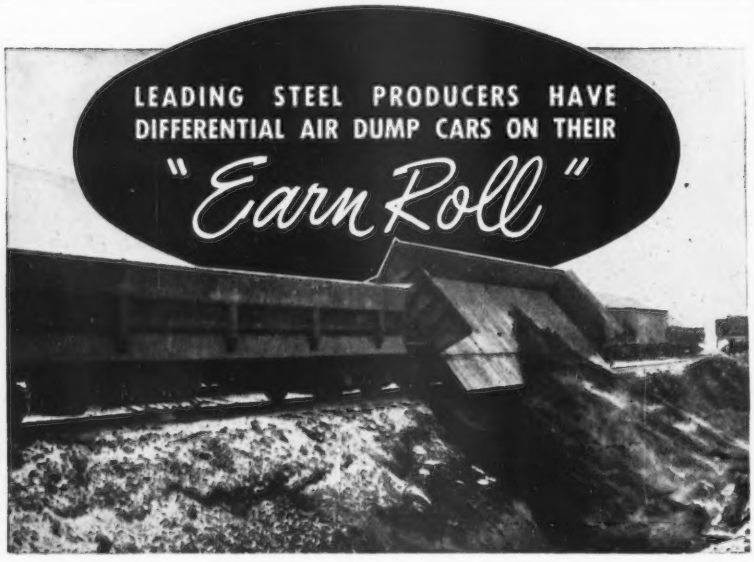

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SINCE 1915—PIONEERS IN HAULAGE EQUIPMENT

Minnesota *(Continued)*

Rabbit lake, is begining its second year of ore production, the first ore having been loaded in May, 1952.

★**Steep Rock Iron Mines, Ltd.,** in its annual report for 1952, states that the production scheduled for 1953 is 1¼ to 1½-million tons, to come from the Hogarth and Errington orebodies, and the production for 1954, 1955 and 1956 will increase to 2, 3, and 3½ million tons respectively. The 800,000 tons expected from the Errington open pit this season will conclude open-pit operations there. Errington No. 1 underground mine will produce about 200,000 tons in the 1953 season with production increasing rapidly toward 1½ million tons per year, its objective. Between 250,000 and 500,000 tons is scheduled from the new Hogarth open pit this season.

The shaft for Errington No. 1 underground mine was completed at 1,250 ft. during 1952. Its drift was well advanced toward the orebody on all three levels.

Exploration was done during 1952 on the 6,000-ft. section known as the "G" ore zone, lying between the Hogarth and Errington orebodies. An orebody over 4,000 ft. long with a width corresponding to the Errington's has been established in this area. These three orebodies, Hogarth, Errington and "G", are all located in what was the middle arm of Steep Rock lake. Exploration in the southeast arm of the lake is planned for this summer. The latter area is three miles long and is known as the "E" zone. Geologically, it is similar to the proven ore-bearing areas of the Steep Rock range. Preliminary exploration has also been conducted in the previously unexplored west arm of Steep Rock lake with encouraging results.

★**The Columbia mine** of Jones & Laughlin Steel Corporation's Minnesota Ore Division has received two safety awards: Sentinels of Safety certificate from the U. S. Bureau of Mines and a Medallion safety award from the J. & L. Corporation. The mine worked twelve consecutive months, starting on Sept. 6, 1951, without a lost-time accident.

★**M. A. Hanna Co.'s** new 690-ft. freighter, the "E. T. Weir," has been approved by inspectors as ready to join the Great Lakes fleet. It is the largest vessel ever built on the Great Lakes. Rated capacity at summer draft is 20,000 tons.

★**An unusual accident** occurred at a Mesabi range mine when a man who was riding in the back of a truck which was going down-grade, suffered a double fracture of his right leg when the truck stopped suddenly and a 687-lb. gear rolled forward, pinning him against the cab. The accident occurred at a property operated by a company which has been most active in safety work. There is always a new way for a man to become injured on the job.

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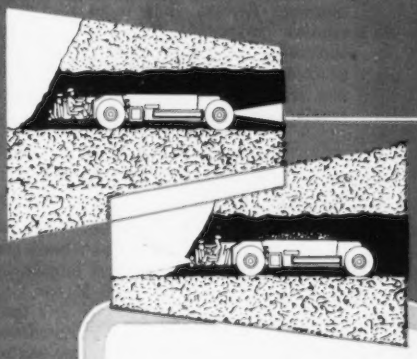

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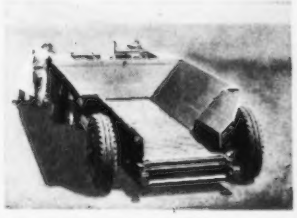
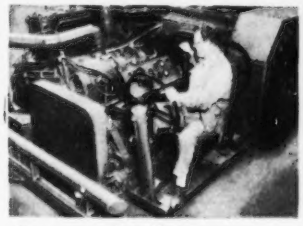


Hydraulic power enables conveyor discharge feed from 0 to 60 feet per minute.



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Minnesota *(Continued)*

★**The new 647-ft. ore carrier, "J. L. Mauthe,"** of the Interlake Steam Ship Co., took her first cargo April 4. Capacity is about 18,500 tons, speed better than 16 mph.

★**Nine operations managed by Pickands, Mather & Co.** have been recognized for outstanding safety records by the National Safety Council. They are the West Hill, Albany, Biwabik, Corsica, Embarrass, Sagamore and Mahnomen mines; also the Erie preliminary taconite plant and Erie laboratory.

★**Several days of cold weather** in mid-April brought washing plants to a halt, delaying all operations and causing a loss estimated at 1-million tons. Despite this, shipments are approximately 2-million tons ahead of last year. Shipments for the season up to April 27 totaled 7,214,621 tons against 5,280,232 tons last year on that date.

★Development of Pickands, Mather & Co.'s **Fortune Lake open-pit mine** is well under way. A temporary headframe, engine house, transformer station and office have been completed; the old 275-ft. shaft has been retimbered, the shaft has been sunk an additional 30 ft. and an 8x9-ft. drainage drift has been driven 870 ft. Over 900,000 cu. yd. of stripping has been moved and ore production is scheduled to begin this August.

★**Stockholders of M. A. Hanna Co.** were told some time ago by G. W. Humphrey, then vice president, that he expected the company's 1953 ore shipments to reach 19-million tons, barring unforeseen developments. This would be an increase of about 33% over 1952's 14,356,740 tons. Hope was also expressed that ore shipments from the Labrador-Quebec area would begin in the fall of 1954.

★**Lake Superior & Ishpeming R. R.,** which hauls most of the ore from the Marquette range to its docks at Marquette, Mich., has ordered 300 new 70-ton ore cars at a cost of $1,800,000, two diesel-electric 1600-hp. locomotives and 100 flat cars. The road carried a total of 3,757,967 tons in 1952.

★**M. A. Hanna Co. paid out** about $350,000 in adjustment, or "inequity," payments on April 28, covering work by employees in certain classifications over the past two years in the Iron River district, Michigan, on the Menominee Range. This is in line with similar payments by other mining companies and is the result of company-union study of rate adjustments and job classifications which has been carried on over a long period.

MICHIGAN

★**Cleveland-Cliffs Iron Co.'s** annual report for 1952 states that work on the Humboldt mine, owned jointly by the CC-I Co. and the Ford Motor Co., has progressed satisfactorily and that the first 200,000-ton unit is scheduled to start in 1954. The report also states that the Republic mine project will be in operation in 1955. Its initial capacity will be 400,000 tons of finished product per year. The "B" shaft of its Mather mine is down 3100 ft. and is rapidly being developed to the point of maximum production. It produced 686,000 tons in 1952, compared to 478,000 tons in 1951. The Boeing mine, at Hibbing, on the Mesabi, has been purchased and added to the company's reserves. The Boeing has an estimated tonnage of 1,324,597 tons remaining. Over 38-million bd. ft. of timber was cut from Cleveland-Cliffs lands in 1952.

MONTANA

★**Finlen & Sheridan Mining Co.,** Butte, is conducting a new industry in this state, mining and milling high grade barite near Elk Creek, in the vicinity of Greenough, Missoula County. The "ore" is opened by a main haulage level tunnel, from which raises are extended into the bodies of barite. An air locomotive hauls the material to bins at the mouth of the tunnel. The ore is crushed to $\frac{3}{8}$ in. and some is sold in bulk at that

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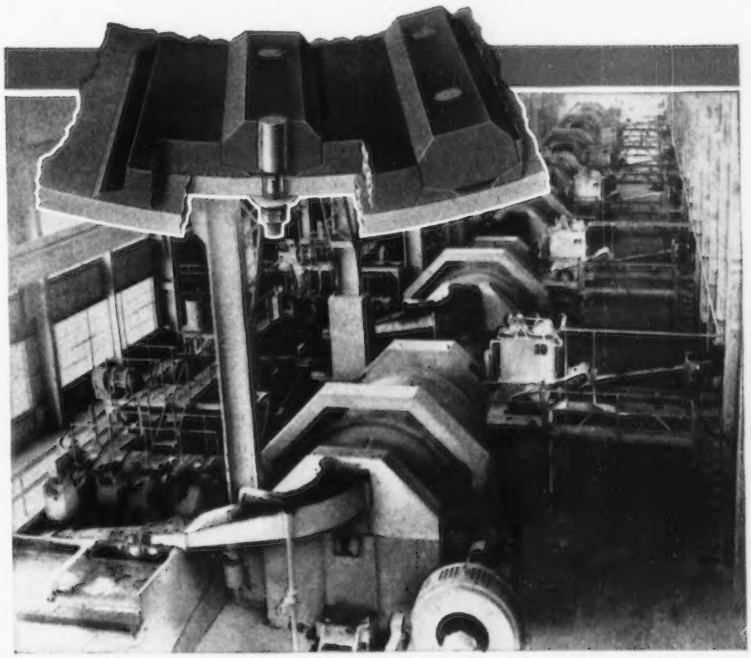

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UNITED STATES STEEL

Montana *(Continued)*

size. Some of the barite is crushed by rolls, semi-automatically sacked and shipped to the trade. Mining began in April, 1951, and crushing started in June, 1952. Finished products are said to be very high grade for the purposes for which they are used and have a ready market. Present production is 12 to 14 cars per week of pulverized barite and 4 to 6 cars of crushed barite, per week.

★**Western Montana Exploration & Development Co., Inc.,** is carrying on metallurgical testing to treat the zinc, lead and copper ores of the Shamrock ore body in Granite County, 10½ miles southeast of Hall, according to Dr. Roy W. Key, Missoula, Montana, president and general manager. The mill flow-sheet is being designed by the Wilmot Engineering Co., Hazelton, Pa., under the direction of Frank Eichelberger, Spokane mining engineer, who has been named consulting engineer and metallurgist.

★**Philipsburg Tungsten Mining Co.,** which was incorporated on April 8 by John W. Cole, Leroy Degenhart, Leslie Applegate, B. G. Paige, J. Chandice Ettien, Ben Walkup and Edward T. Irvine, all of Philipsburg, expects to develop the Combination mine in the Black Pine District, 11 miles northwest of Philipsburg, Granite County, Montana, and is planning to construct a mill to concentrate copper, silver and tungsten.

★**Defense Minerals Exploration Administration** has granted a loan to W. R. Wade and H. G. Obendorf of the Ottawa Tungsten Co. at Marysville, Lewis and Clark county, for the development of tungsten ores.

★**Essey and Locust mining claims,** located in Soap Gulch, near Melrose, Silver Bow County, will be reopened by Frank McKinney of Butte. The properties last were worked in 1938 and exposed gold and silver veins.

★**Montana Standard Mining Co., Ltd.,** consisting of nine patented claims and one unpatented claim, about 12 miles west of Thompson Falls, Sanders County, expects to resume operations within the next several months, according to Loy L. Vose, president, of Wallace and Burke, Idaho. The property has not been actively worked since 1934. Veins show lead, silver and zinc ores.

★**U. S. Gold Corporation,** after a winter shutdown, is resuming development work at its property near Twin Bridges, Madison County. Frank J. Luedke, prominent Idaho mining operator, has been elected to the board.

★**Southern California Minerals Co.** announces the discovery and commencement of mining operations of its Treasure deposit of steatite grade talc near Dillon, Montana. At Barratts, Montana, where their own water is available, they have a 20-acre mill site and a complete ore washing plant in operation.

Here is a typical assay:

Silica	61.26%
Mag. Oxide	33.14
Calc. Oxide	0.20
Alum. Oxide	0.79
Ferric Oxide	0.11
Sodium Oxide	0.03
Loss on Ignition	4.35

NEVADA

★**Twelve men are at work** at the Summit King mine near Tonopah where an important ore strike was reported last summer. A winze is being sunk on the 300-ft. level and plans include drifting and raising in the underground workings.

★**At the Mohawk silver mine** in the Silver Peak district five men are working underground and three on the surface doing development work. The crew is extracting about 20 tons of ore a day and also moving out about 15 tons of waste material. The company is drifting on the 500 and 200-ft. levels and expects to continue for some time. E. J. Shirley, of Silver Peak, is superintendent of the workings.

★**New tests in Dixie Valley,** where

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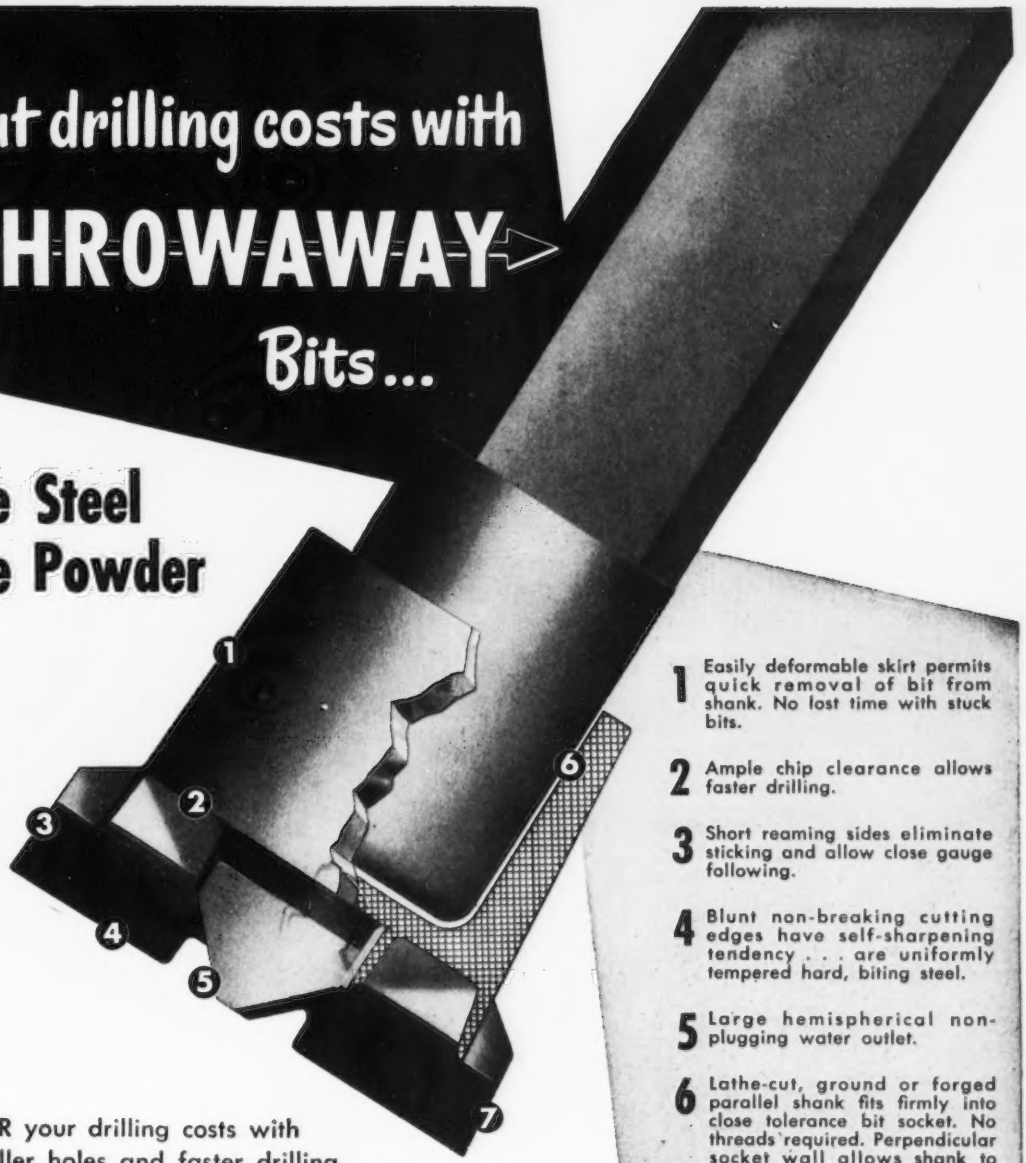

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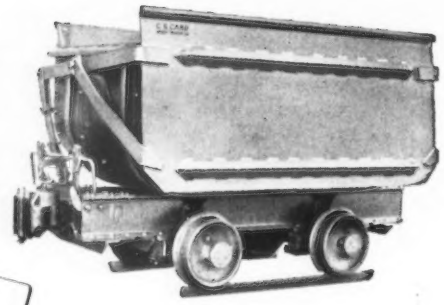

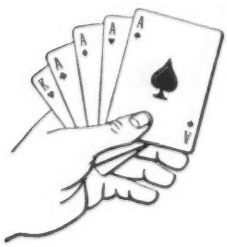

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Nevada *(Continued)*

large copper deposits have been found, show good promise, according to Charlie McKay, of Eureka, and Andy D. Drumm, of Fallon. The two men own a claim east of the big project contemplated by Consolidated Copper Mines Co. One 100-ft. shaft showing copper ore from the collar to the bottom has been cut at the "old smelter" in the northeasterly corner of Churchill county.

★**Argentum Mining Co.** is operating the Northern Belle mine in the Columbus district, on the site of the old mining camp of Candelaria. Good grade of sulphide ores is being produced, and a crew of 12 men is working on the property. Milling machinery is being assembled at the mine site. E. S. Gates, of Mina, is president of the company, and Thomas Earl is superintendent. Present work is being carried on at the 1500-ft. level under the basalt capping which is characteristic of the Candelaria camp.

★**Backlogs of copper ore** at Consolidated Copper Mines' Morris Pit near Kimberley have caused a slow-down in the Isbell Co.'s operations there. Removal of overburden which had been progressing at the rate of 35,000 tons daily was reduced to 10,000 tons per day during April. The Morris Pit is being worked on a three-shift basis, and Isbell is employing 67 men on the project for removal of the overburden. Frank Quilici is superintendent of the operations.

★**Garnet Tungsten Mine Co.** has taken a lease and option on the Montrose property 18 mi. east of Mountain City. Owners of the mine are Knowles Brothers and Price Montrose. Diamond drilling and development work has been largely completed, and four men have been at work in the tunnel which has reached a depth of 200 ft. The ore bodies extend 700 ft. long in one place and from 12 to 80 ft. wide, according to the operators. There will be open pit operations later on, and mill construction is being planned.

NEW MEXICO

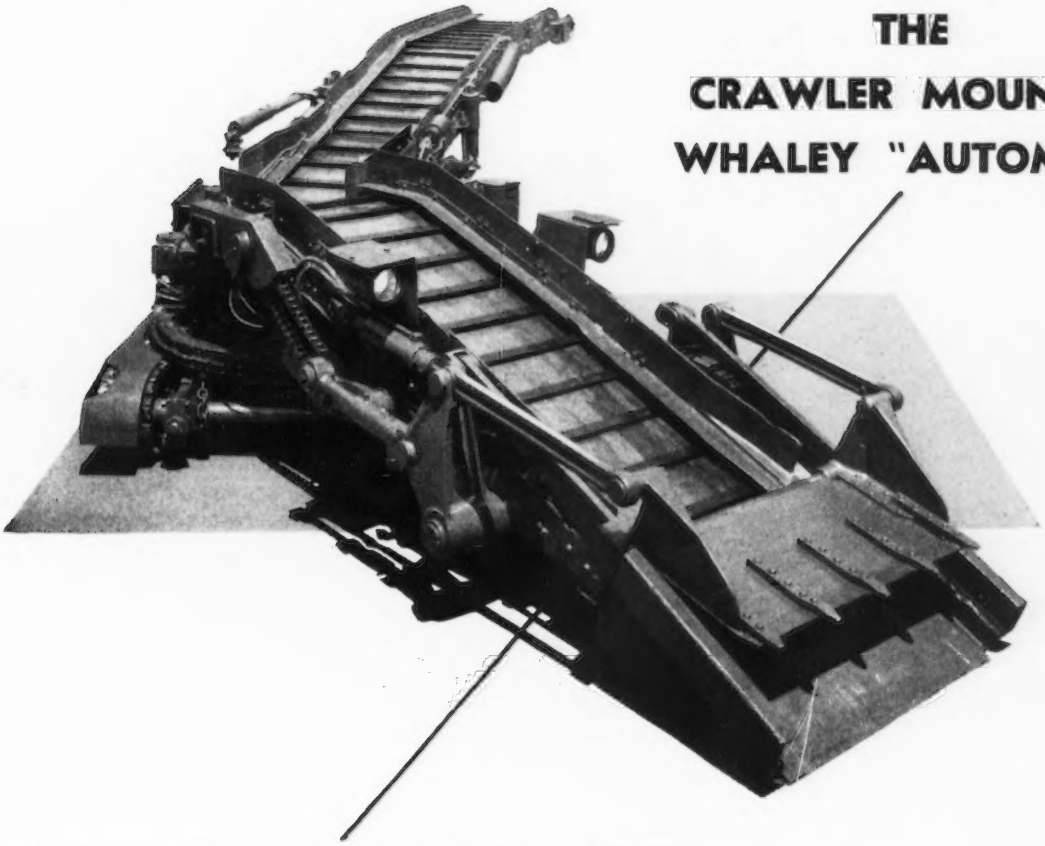
★**Phelps Dodge Corp.** is considering re-opening its huge open-pit copper mines at Tyrone, near Silver City, after a shutdown of nearly 30 years. During the past two years the firm has carried on extensive diamond drilling operations to explore ore bodies.

If re-opened the mine could provide jobs for some 700 miners idled by the shutdown of zinc and lead mines in the Grants County district.

★**International Union of Mine, Mill and Smelter Workers** signed contracts effective May 1, 1953, with Duval Sulphur & Potash Co., International Chemical and Minerals Corp., and Potash Co. of America. The Carlsbad Potash Union and the United Potash

★ . . . to meet the needs of metal and non-metallic mining for greater production . . . . .

THE CRAWLER MOUNTED WHALEY "AUTOMAT"



Metal mining men who have recognized our track-mounted Whaley "Automat" for its superior mechanical ability to do a more efficient job consistently in rock loading, have often suggested that we put the "Automat" on a Crawler Mounting. This we have done to meet the needs of metal and non-metallic mining for greater production at reduced cost.

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New Mexico *(Continued)*

Co. announced a similar settlement. All contracts call for an increase in base wages of 22c. an hr. including 18c. previously paid under a cost of living escalator clause and 4c. an hr. in additional wages.

Net effect of the agreements will make the top mine rates $2.07 and the journeyman rate $2.10. Production bonus will be added. Cost of living escalator has been eliminated from the contract. Under the terms of the contract, there will be no retroactive recapture or reduction in cost of living allowance overpayments which as of May 1 total about 8½c. an hr.

The Carlsbad Potash Union and U. S. Potash also announced acceptance of the new bonus plan. The Southwest Potash Co. will be affected by the contract under a "grandfather" clause. District 50 of the UMW and Southwest signed a contract several months ago.

★**Expanded uranium mining** in the Laguna-Grants-Prewitt area has been temporarily delayed by a fire at Anaconda's new mill under construction at Prewitt, which destroyed some equipment in storage. While work was not stopped on the main building, there will be some delay while replacements of machines and equipment are obtained.

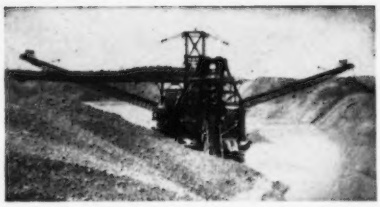
★**Representatives of Kerr, McGee Oil Industries, Inc.** have resumed discussions with Indian Service and Navajo tribal officials on a proposed $2-million uranium mill at Shiprock. The company holds leases on 960 acres of Navajo land. Shiprock is the site of a purchasing depot for uranium ores from the "four corners" area.

★**New equipment** is being received by Potash Company of America, Carlsbad district, in connection with a $3-million modernization and expansion program which is well under way. The project includes installation of a new belt conveyor system for more efficient transportation of ore from the working faces to main haulage ways in the mine, a new 5,000 kva transformer and a new bagging machine, conveyors and automatic scale to double the bagging plant's output.

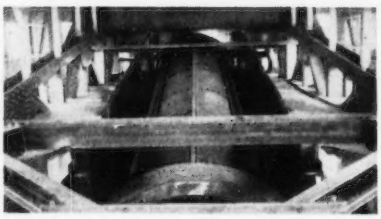
OREGON

★**Chrome ore activity** in southwest Oregon has stepped up with advent of the working season and changes in the chromite stockpiling program. Revisions involve abandonment of restriction to 5,000 tons on annual tonnage acceptable from any one buyer at the government depot in Grants Pass. Government buying will remain in effect through June 30, 1955.

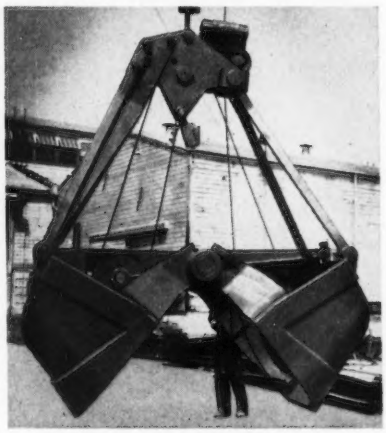
Most of the chromite mining has been in Jackson and Josephine Counties in the two years of the Defense Material Procurement impetus but



YUBA Bucket Ladder Dredges for dredging placer properties including rare earths, etc.; handling sand and gravel, dam construction, channel changes, etc., Bucket sizes: 2½ to 18 cu. ft. or larger. Digging depths below water as required.



YUBA Abrasion Resisting Steel Screens—Flat or revolving for separating, scrubbing, sizing. Holes taper drilled to prevent clogging. All thicknesses from ¼" up; other dimensions as needed. U·S·S· AR plate carried in stock.



Stockton "Yubabilt" Clamshell Buckets, for channel, harbor and reclamation dredging. Two types: California and Power Arm (shown here). Three weight classes: heavy, standard, special light weight. ½ to 6 cu. yds.

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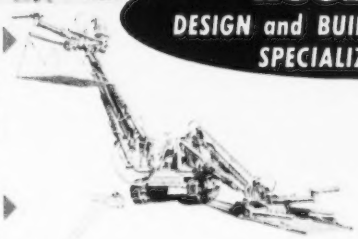
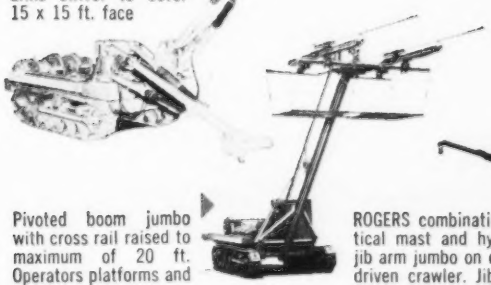
ROGERS hydraulic jib arm jumbo with one arm at lowest position. Each arm swivels horizontally to cover a face 20 ft. high by 16 feet wide.

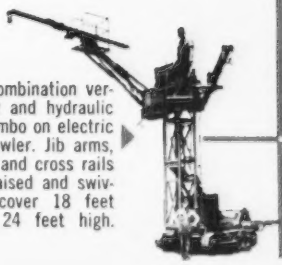


ROGERS hydraulic jib arm jumbo, crawler mounted, air driven, controls on jumbo. Jib arms swivel to cover 15 x 15 ft. face



Pivoted boom jumbo with cross rail raised to maximum of 20 ft. Operators platforms and drill sashes remain level.

ROGERS combination vertical mast and hydraulic jib arm jumbo on electric driven crawler. Jib arms, platforms and cross rails may be raised and swiveled to cover 18 feet wide by 24 feet high.



ROGERS vertical fixed mast jumbo with dual operators' platforms; raises to 30 ft. elevation.

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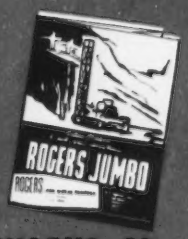

Write for Bulletin 51-3

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Not a thing of beauty, but almost perfectly executed for its habitat is the Hippopotamus. At home in swamps and rivers...yet able to travel at amazing speed on land, the Hippo, with a 1½" hide, can cope with any hazard but a missile in the brain. He is a good example of perfect design for a hazardous environment ...as is the SKOOKUM SLUSHER BLOCK...a block carefully made to operate flawlessly in dust, muck, mud or under water. Its Timken roller bearings are protected by a patented grease seal. Broad throat passes knots. Manganese sheave is virtually non-wearing. No wonder Skookum is preferred by the majority of mine operators. **WE BUILD TO YOUR SPECIFICATIONS.**

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Skookum Slusher Block 7085 —Extra Broad Throat, holds 4½ times more grease. Special alloy sides and sheaves.

Oregon *(Continued)*

neighboring Douglas County may become more active. This was revealed when Robert Kischel, head of the Douglas County Lands Department, revealed two operating firms of the neighboring counties have been investigating lease of county lands on a royalty basis.

Only potential barrier to the Douglas development is transportation to the depot at Grants Pass.

Chromite ore is purchased at the depot on a base price of $110 a ton for 35% ore. A U. S. Bureau of Mines report for January lists 815 short tons received at Grants Pass that month; 1,232 short tons in February. In the two years of the government program, receipts at the depot have represented all domestic production, with the exception of one California producer. In 1951 this amounted to 7,056 tons; in 1952 receipts were 21,216 short tons.

UTAH

★**International Smelting & Refining Co.** smelter at Tooele reopened May 1, after being shut since Jan. 1 as a result of the lead-zinc price situation.

F. A. Wardlaw, Jr., general manager, reported resumption of full production on a normal five-day week basis, with a total payroll of 500 persons. He reported that a stockpile accumulated since January, plus added ore expected to come in, should assure full plant operation for at least the remainder of 1953. Stockpiling of lead-zince ore had continued throughout the shutdown period.

★**Stockholders of Silver King Coalition Mines Co.** have voted to approve consolidation of the firm with Park Utah Consolidated Mines Co., to form a new company to be known as United Park City Mines Co. While a simple majority was required under terms of the firm's Nevada charter, the Silver King meeting resulted in voting of 702,607 shares for consolidation, and 18,357 against.

★**Chief Consolidated Mining Co. has** installed a new underground hoist on the 1,800-ft. level of its Chief No. 1 mine at Eureka. The hoist cost $93,000 with total cost of the project given as $145,000 by Cecil Fitch, Jr., vice president and general manager.

"The new hoist is capable of a vertical lift of 3,000 ft., or from what would be our 4,800-ft. level," Mr. Fitch pointed out.

★**Underground and open-pit mining of commercial clays** by Dragon Consolidated Mining Co. resulted in a 1952 net income of $38,696 without deduction for depletion, J. William Knight, president, has reported. The 1952 output of shipping quality haloysite clay was 60,917 with 23,653 tons coming from the open pit and 37,264 from underground operations.

Specify THOMAS ALL METAL FLEXIBLE COUPLINGS for Power Transmission to avoid Costly Shut-Downs

DISTINCTIVE ADVANTAGES	
FACTS	EXPLANATION
NO MAINTENANCE	Requires No Attention. Visual Inspection While Operating.
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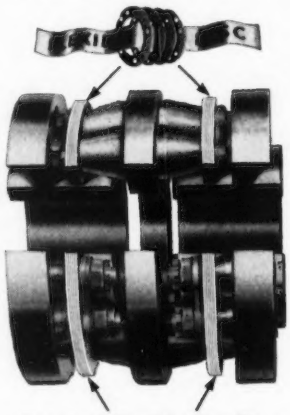
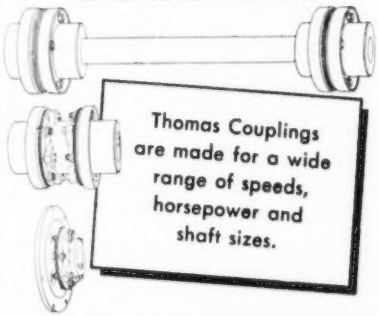
PERMANENT TORSIONAL CHARACTERISTICS	Drives Like a Solid Coupling. Elastic Constant Does Not Change. Original Balance is Maintained.



Patented Flexible Disc Rings of special steel transmit the power and provide for parallel and angular misalignment as well as free end float.



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TEE CEE Liddicoat Bits

[Tungsten carbide inserts]

Liddicoat TEE CEE and "single use" bits both fit the same drill steel.

It's here . . . ready to go into action for you! It's the new Liddicoat Tee Cee (Tungsten Carbide insert) Bit, designed for on-the-job interchange with the famed Liddicoat Bit that is "used to destruction." Both fit the same steel. The same strong Liddicoat connection — no threads to strip — is used for both. With the new Tee Cee bit, users of Liddicoat now have a detachable bit best suited to conditions. The TEE CEE Liddicoat is the result of years of testing and research by the Western Rock Bit Manufacturing Company.

The socket of the Liddicoat TEE CEE bit is machined to an accuracy in thousandths of an inch, a degree of precision that means a stronger connection and longer bit and rod life. Flat sections — four or six — within the socket correspond with the flat sections of the drill steel — securely locking the bit to the rod.

Equipped with the new TEE CEE bit and the Liddicoat single-use bit, users have assured performance and economy in all drilling operations.

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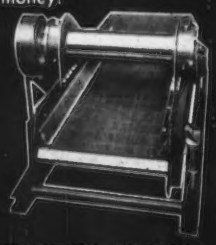

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IN CANADA

MANITOBA

★**Sherritt Gordon Mines Ltd.** has completed its winter tractor-train haul to Lynn Lake, and next winter will see the operation of the new railway. Construction at Lynn Lake has continued well within the schedule which should see the mine and surface plants ready for production when the railway is completed. Construction of the chemical-metallurgical plant at Fort Saskatchewan, Alta., is up to schedule.

★**San Antonio Gold Mines Ltd.** reports preliminary drilling at its new copper-nickel prospect near the Ontario-Manitoba boundary has revealed a strong mineralized zone. An electrical survey completed this winter shows numerous favorable areas which will require investigation. Associated with San Antonio in the prospect is Central Manitoba and the Jeep Gold Mine, each having a one-third interest.

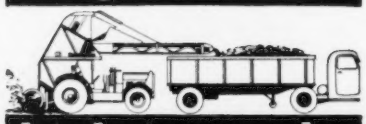
★**Nor-Acme Gold Mines Ltd.** has declared a 3c. a share dividend payable May 15th. The property is operated under lease by the Howe Sound Co. Ore reserves are reported to be very satisfactory. The 1030 level shows greater length and better grade of ore than on upper levels.

★**Hudson Bay Mining & Smelting Co.** estimates net earnings for the three months ending March 31, 1953, as $3,378,268 or $1.22 per share. This compares with $1.59 for the corresponding quarter in 1952. Tonnage milled was 360,161 compared with 397,430 tons in the first quarter of 1952.

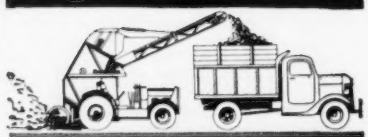
BRITISH COLUMBIA

★**Many world-famous mining companies** are investigating B. C. ore potentials, including two British firms with South African gold and copper interests, and some big U. S. firms. British newcomers are Ownamin Ltd., Canadian subsidiary of Rio Tinto Co., and Selco Corp., Ltd., Canadian offspring of Selection Trust Co. of London. Other companies exploring and prospecting include: Granby Consolidated Mining, Smelting & Power Co., Ltd., prospecting the Unuk River area; Conwest Exploration Co., along the Alaska Highway and in the northern portion of the Yukon; Hudson's Bay Mining & Smelting Co., at Kluane Lake on Canol Pipeline Road; Consolidated Mining & Smelting Co., with parties "all over"; and Britannia Mining & Smelting Co., re-prospecting many of its claims more intensively; Berens River Mines, Ltd., subsidiary of Newmont Corp., "looking for B. C. properties"; Noranda Mines, Ltd., developing a copper property at the north end of Vancouver Island; Technical Mine Consultants, Ltd., Toronto,

longest trucks



highest trucks



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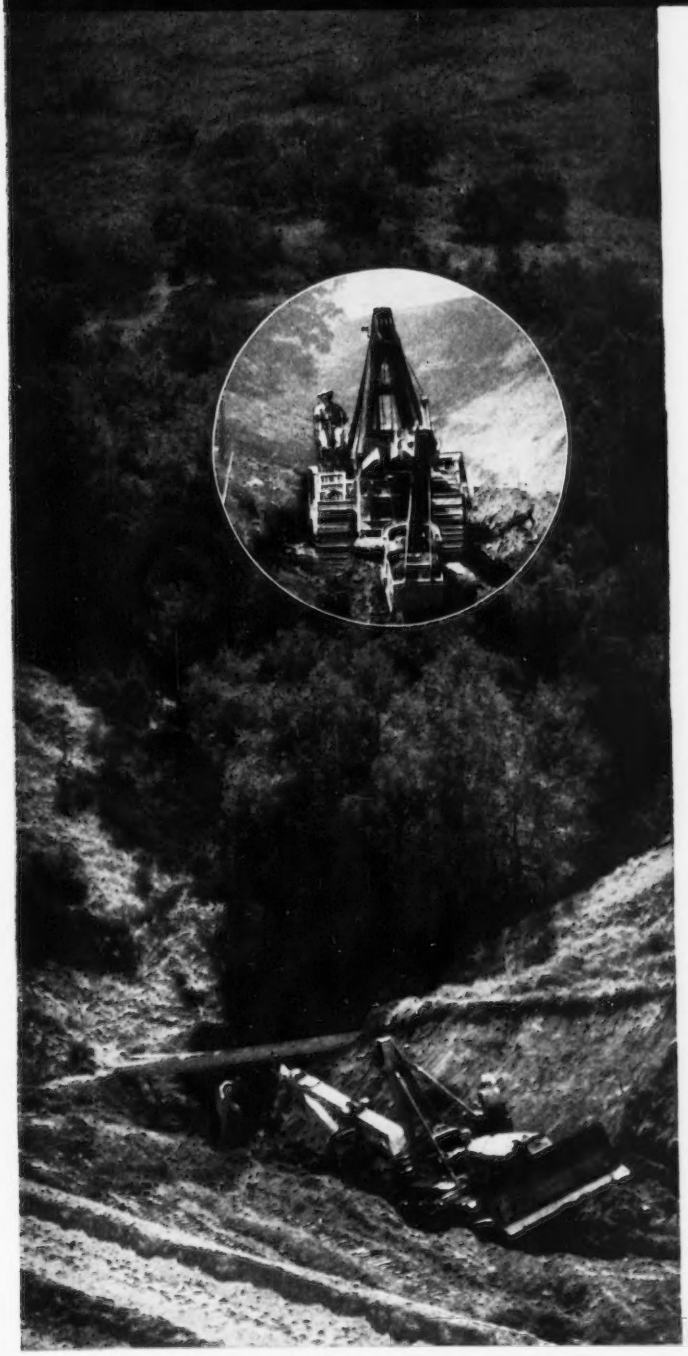

and travel at tractor speed. This means more jobs done, faster, with less equipment.

Only HYSTAWAY has *true* crawler tractor mobility and maneuverability because it mounts on a Caterpillar track-type tractor. Full track oscillation enables the Hystaway to travel over rough terrain without excessive damage to crawler equipment . . . eliminating the cost and necessity of having expensive standby hauling equipment on hand. Hystaway is the *only* revolving shovel with a complete track-type tractor for its undercarriage! This is the feature that makes the Hystaway the most modern excavator-crane available today.

Other important HYSTAWAY MONEY-MAKING FEATURES INCLUDE: The ability to do excavator-crane work and bulldozing with one piece of equipment; heavy duty diesel tractor engine for power; no tail swing, permitting work in close quarters; mountability on new or used Caterpillar track-type tractors.

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1. Shovel
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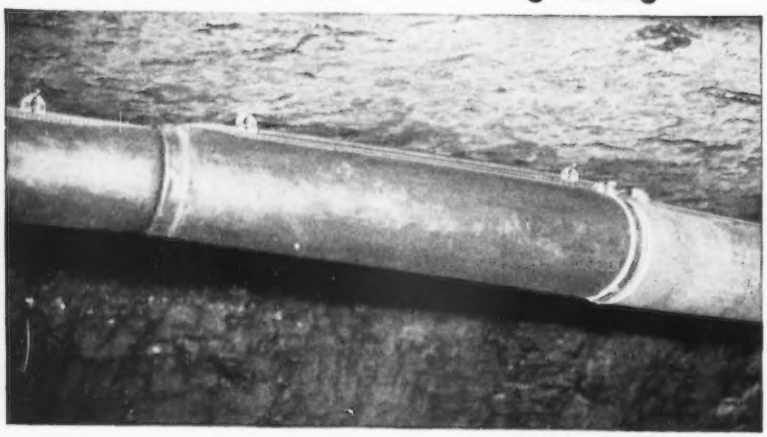

Flexipipe is now available with Rope Seam Suspension *at no additional cost.* The newest, best, quickest suspension . . . eliminates special accessories and suspension wires . . . *all you need is a nail.* It equalizes strain on the tubing.

Flexipipe is efficient, serviceable, economical. Jute and heavy-duty grades available in a variety of lengths and diameters to meet your requirements.

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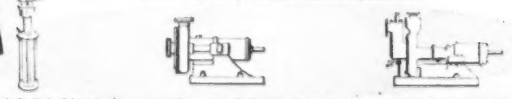


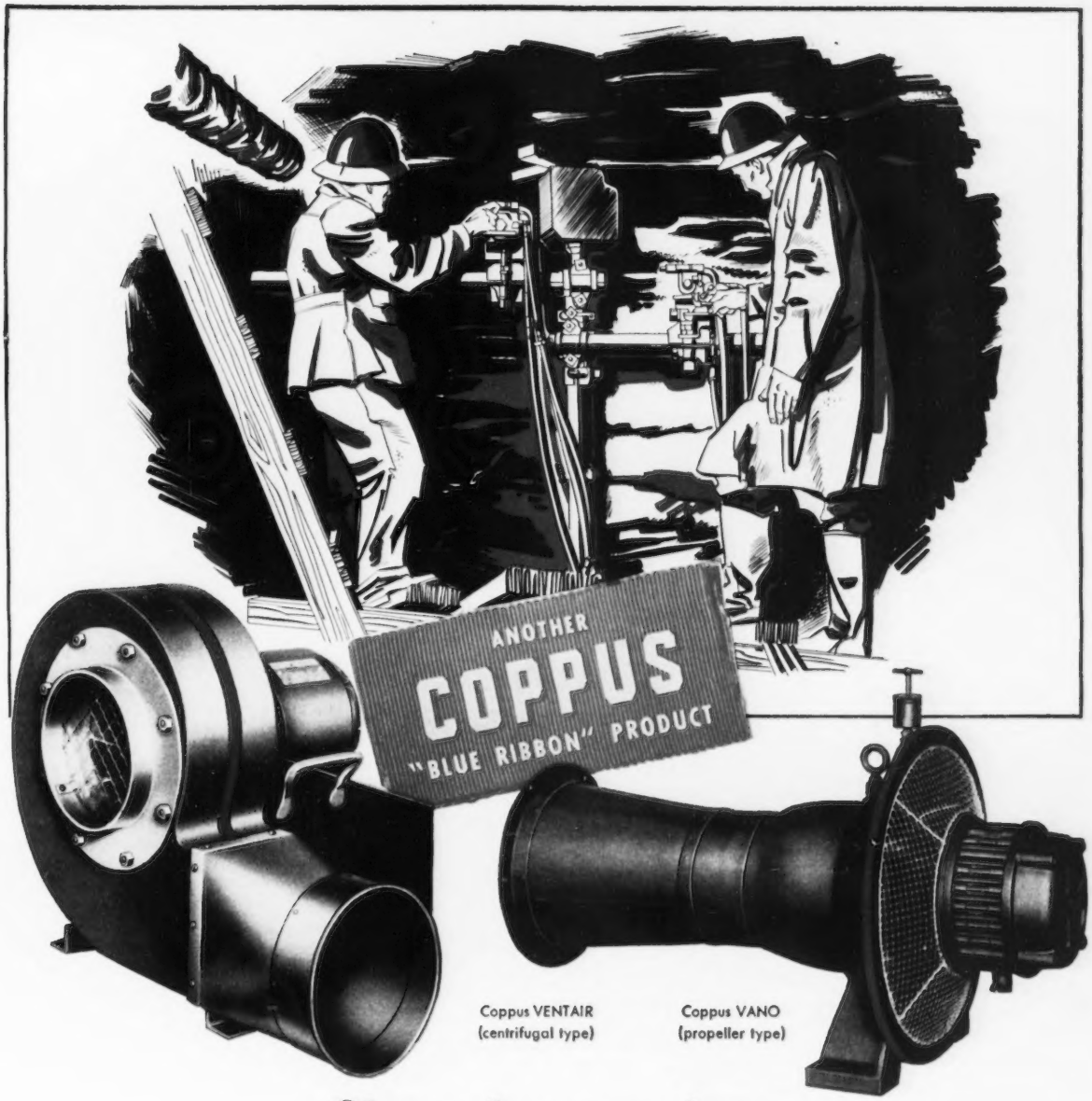
PUMPS FOR ABRASIVE AND CORROSIVE APPLICATIONS

Canada *(Continued)*

active on gold and tungsten properties, including those around Whitesail Lake in Tweedsmuir Park, and uranium-fluorspar deposits on the North Thompson river; St. Eugene Mining Corp., Ventures Ltd. subsidiary, also on North Thompson. New Jersey Zinc Explorations, Ltd., U. S. firm, plans development around Ymir, while also active are Transcontinental Resources and Northwestern Exploration Co., subsidiary of Kennecott Copper Corp.

★**There's a hint of better things** in store for B. C.'s base metal mines which have been jolted—and some closed—by dropping prices and cutbacks in custom treatment of ores by Consolidated Mining & Smelting Co., key plant in the province which has been battling low prices and heavy stockpiles. The hint came from Cominco's president, R. E. Stavert, who told the annual meeting in April that demand for lead and zinc had shown considerable improvement since the company's annual report was issued in March, and refined zinc stocks had been reduced while stocks were below normal. However, the hint was balanced by caution, and while the increased demand and decreased stockpiles appeared to offer some hope to private operators of an upward trend, Stavert cautioned, "In the long run, current prices would seem too low to bring out sufficient metal to meet world requirements, but it will probably take some time to absorb excess stocks of zinc and to bring supplies of lead and zinc into closer balance with demand." Cominco is suspending expenditures of $22-million required to get its new HB base metal mine and mill at Salmo into production "until the market situation becomes somewhat clearer." Despite all this, Stavert's report to shareholders was not too gloomy: "Our production of lead, zinc and fertilizers in the first quarter of this year was about the same as the 1952 rate. Silver production was about 20% higher. Our chemical and fertilizer business remains satisfactory and we are continuing to find a ready market for all we can produce. With the exception of cadmium, the demand for which is still light, our volume of metal sales is satisfactory." Profits were running considerably below 1952 because of price drops, but he was confident that, with the cooperation of employees in maintaining production costs, the company's position could be maintained and improved.

★**Sheep Creek Gold Mines Ltd.**, with one of its base metal mines closed and the other struggling against low prices, is planning to bring a new property into production, Mineral King, in the Windermere area. J. R. Pyper, Sheep Creek vice president, says: "Grade of ore and tonnage developed thus far warrant erection of a milling plant for treatment of a minimum of 400 tons daily." He expects the property to be able to oper-



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Canada *(Continued)*

ate at today's lead and zinc market prices.

★**Estella Mines Ltd.** plans to resume lead and zinc production at Wasa in June or July. Decreased costs and higher mill efficiency are expected to more than offset the drop in metals prices since last December, when the mill operated at a profit of more than $125,000 at a rate of 200 tons daily. Combined savings are estimated at $9 to $10 per ton. The company has contracts for lead and zinc at current prices. Meanwhile, a crew is going into the Little Gem gold-uranium-cobalt property at Bridge River and a nearby asbestos deposit has been acquired for exploration at the same time.

★**Tungsten of British Columbia Ltd.** will emphasize copper and antimony in its northern B. C. developments. Dr. J. T. Mandy, consulting engineer, estimated gold-silver-copper ore with a gross value of $230,000 could be developed on two veins of the Bell-Grotto group near Usk, 130 mi. east of Prince Rupert, within the next four months with expenditure of $24,500, and profit after mining and milling was estimated at $54,000. Antimony in the Snowbird group near Stuart Lake was described as one of the outstanding deposits in Canada.

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★**Exploration is under way** on a copper showing six miles from Aluminum Company of Canada's West Tahtsa camp at the upper end of Alcan's hydro tunnels. Trenching and diamond drilling, to a depth of 200 ft. to start, is being carried out under direction of George A. Young of Vancouver, who, with C. McNeill of Ootsa Landing, staked on the showing in 1950. Kemano Copper Mining Co. Ltd. has acquired an option to purchase 18 claims.

ONTARIO

★**First gold mine** in many months to announce expansion plans is Campbell Red Lake, Dome subsidiary in the Red Lake camp. Fine ore results in the new North zone have prompted the management to finalize plans for mill increase to 750 tons from the 500-ton rate at which the plant is currently operating. Plans have also been made to deepen the shaft 1,000 ft., and it is expected that both projects will reach completion early in 1954.

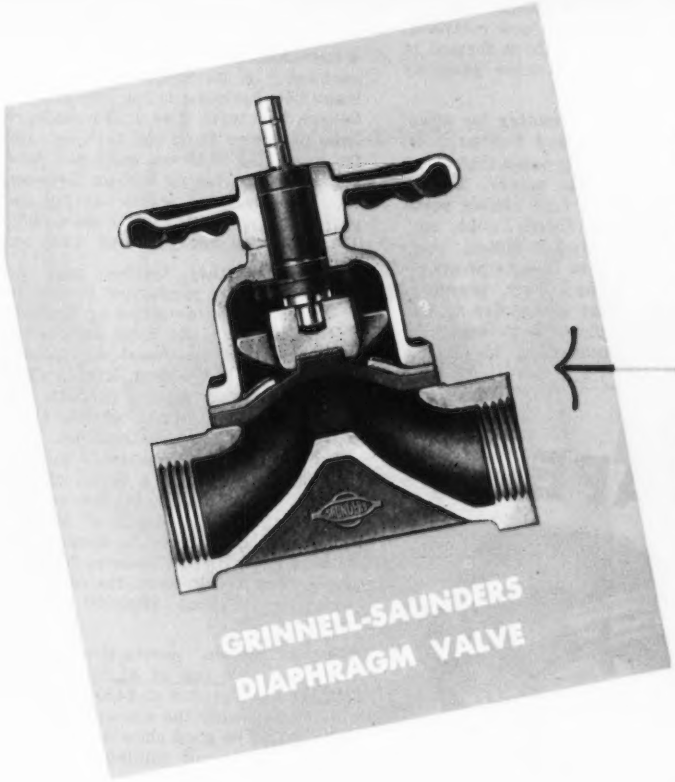
★**Ontario Nickel Mines,** inactive several years, has taken an option on a copper-nickel prospect some 10 miles north of the town of Marmora, Eastern Ont., on which diamond drilling has been started. Previous work indicated a big width of low-grade values which at that time, some years ago, were below ore category.

The company's most promising asset, however, is still its vendor position of 1,200,000 shares in East Rim Nickel Mines, now busy at mill installation at its property on the east rim of the Sudbury Basin.

★**With more than $500,000 in the till,** Sudbury Northrim Exploration Co. is surface drilling its 1,000-acre property south of the Falconbridge showing near Emo, Fort Francis area, Northwestern Ontario. This nickel prospect was acquired early this year, the company's previous activities having been concentrated on its big holdings (12,000 acres) on the north flank of the Sudbury Basin. The company also holds a financing interest in Fallmac Mines, with ground in the Sudbury area, and in Chibougamau Copper Corp., busy drilling on the Williams Lake property formerly held by Scott Chibougamau Mines in Quebec's Chibougamau area.

★**Falconbridge Nickel Mines** had probably its best year yet in 1952, even though net profits were down slightly (69¢ per share compared with 88¢ in 1951). Tonnage of ore mined and poundage of metals produced both reached new peaks, as did total sales; but the highlight of the year was a 72% expansion of ore reserves, mostly attributable to the new nickel-copper deposit outlined by drilling on the company's Fecunis Lake ground in the Levack section of the Sudbury Basin.

Falconbridge now has five mines: the original Falconbridge and the Me-



The valve originally designed to eliminate

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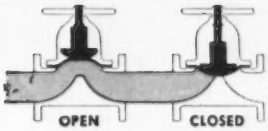

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Streamlined flow. Smooth, streamlined passage, without pockets, prevents trapping of solids. Frictional resistance is at a minimum — regardless of direction of fluid flow. No disc holder in fluid stream.

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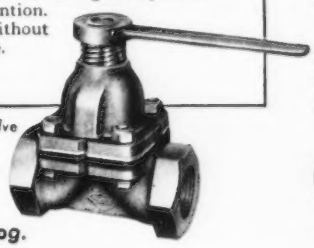
Minimum maintenance. No refacing or reseating is required. No packing glands to demand attention. New diaphragm can be inserted without removing valve body from the line.



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Canada *(Continued)*

Kim, both producing; the East Falconbridge and the Hardy, both just past initial shaft sinking stages; and the Fecunis Lake, where a shaft will possibly be started this year. Motivation for the company's big expansion program comes from its contract with the U. S. Government, requiring delivery of 50-million lb. of nickel over a nine-year period.

★**Sponsored by MacLeod-Cockshutt Gold Mines,** a nickel prospect is being explored in the north shore of Lake Superior, 140 miles northeast of Port Arthur. The ground has shown extensive nickel mineralization in surface prospecting, and a new company, Pic Nickel Mines, has been formed to investigate the north-shore property more closely.

★**The most popular country** for nickel hunting is still around Sudbury; or, rather around the big basin that takes its name from that center. Levack Nickel Mines, with four claims north of Falconbridge's Hardy mine, and New Dominion Nickel Mines, reorganized this year to resume prospecting on its Norman Twp. property, are the two latest companies to announce drilling plans. Both expect to be active all summer.

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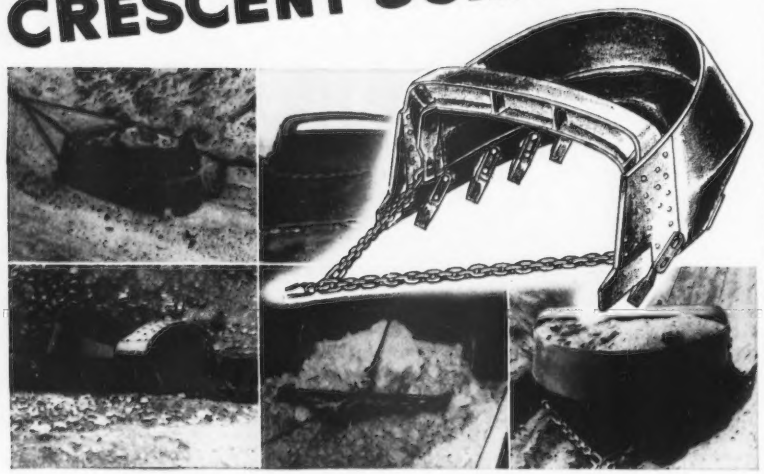

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QUEBEC

★**East Malartic Mines** has proved the continuity of its fine deep ore for at least two horizons below the present bottom 16th level. Two drill holes have been put down from the 16th cut, 190 ft. averaging 0.33 oz. gold per tone and 155 ft. averaging 0.16 oz. Between the 14th and 16th levels the big deposit has been drilled off to show 605,-350 tons with cut grade of 0.235 oz.

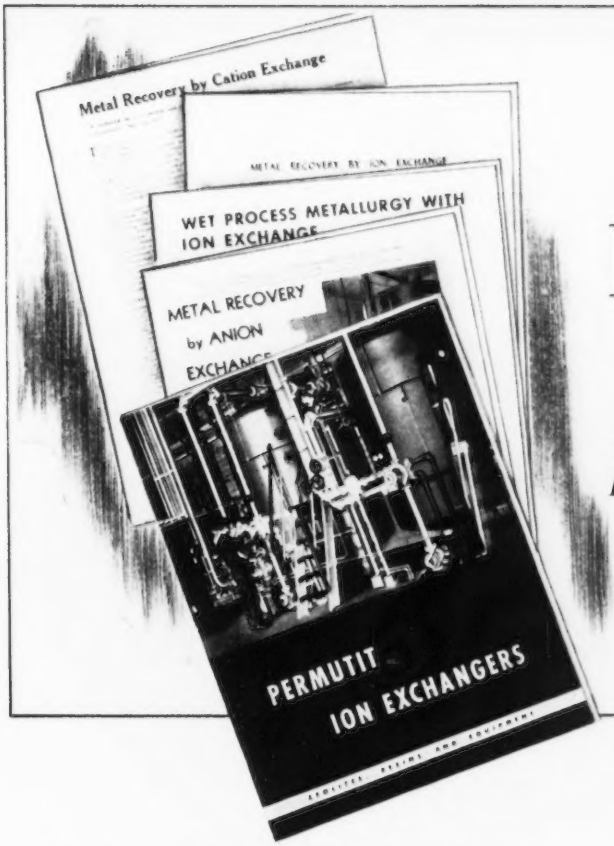
★**Possibility that Quebec** may be slated for nickel production is seen in the results being obtained by Eastern Metals Corp. on its 5,000-acre property 65 miles southeast of Quebec City. Work on the first level at 170 ft. has disclosed results in both the copper and nickel zones corroborative of surface drilling indications. The management now estimates 1.5-million tons of nickel ore to a depth of 550 ft., and 750,000 tons in the copper zone to the drilled depth of 300 ft. Plans have been made to deepen the shaft to 1,000 ft., and finances for that purpose are well in hand, the company having more than $500,000 in its treasury.

★**Barnat Mines,** production value reached a new top of $1,391,540 for 1952, and net profits at $430,808 were more than double the amount marked up in 1951. The good showing was due to the transfer of mining effort to the North zone which has been under development since 1949. The future looks bright for Barnat, too. Development is coming along smoothly, and the 1,075-ft. level, not yet being mined, is shaping up as the best to be developed in the mine to date. Proven ore reserves increased 25% in 1952, rising from 400,000 to 500,000 tons.

★**The green light is shining** for mill construction by Campbell Chibougamau Mines, following arrangement of a $5.5-million credit with the Export-Import Bank in Washington. Plans have been advanced for a plant with starting capacity rate of 2,000 tons daily, with production to commence in 1955. Initial milling will be at 1,700 tons.

Shaft sinking at this pioneer property of the Chibougamau area was completed last month to 1,225 ft., and lateral work is in progress on six levels, of which two, those at 400 and 550 ft., saw their first drifting some months ago. The whole project will have taken a capital investment of $8.8-million by the time production starts.

★**The deep exploratory drive** on Quemont Mining Corp.'s 1,260-ft. level is now across the Donalda boundary, and well into the property of the latter company. The heading is driving in porphyry, with the favorable porphyry-breccia contact a few hundred ft. ahead to the south. The drive is several hundred ft. below the deepest Donalda workings, and is being put out in the hope that Donalda may find copper ore along the contact of the formation.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Philippine Gold Mine Production, March 1953

Mine	Tons Milled March/52	Tons Milled March/53	Value @ $35/oz. March/52	Value @ $35/oz. March/53
Atok Big Wedge	13,546	13,239	$150,000	$96,258
Baguio Gold	5,159	8,777	36,000	81,677
Balatoc	39,461	43,003	302,820	291,500
Benguet Cons.	36,623	44,224	297,276	302,576
Coco Grove	148,000 cu. yd.	150,579 cu. yd.	10,600	21,270
Itogen	11,284	16,042	109,170	106,534
Mind. Mother Lode	11,200	11,300	124,090	136,887
San Mauricio	..	9,530	..	161,142
Surigao Cons.	11,724	14,401	195,000	173,267
United Paracale	..	6,847	..	64,200

NOVA SCOTIA

★**A good outlook for 1953 sales** is reported by Barymin Co., operating Canada's only barite mine. Sales in 1952 amounted to 120,000 tons and were largely responsible for the 15c. per share which the company earned; and it is possible that 1953 will top last year's record by as much as 50%. Ore reserves are well ahead of production, increasing in 1952 to a new record at 1.5-million tons.

SASKATCHEWAN

★**Beaverlodge Uranium Mines Ltd.,** Vancouver, B. C., controlled company, has been informed by Dr. J. T. Mandy, consulting engineer, that a substantial tonnage of uranium ore is expected to be available from the Bar-5 vein on the Bar 5-9 group when the Eldorado mill is completed in the near future. The Bar 5-9 group is on Mickey Lake, 1.5 mi. from Eldorado's Ace shaft, Beaverlodge operation. The company holds six groups of claims adjacent to the St. Louis fault, the big Eldorado orebody, but is concentrating present development on the Bar 5-9 group.

★**Dorreen Mines Ltd., B. C.,** base metals firm, has acquired 13 claims in the Beaverlodge Lake uranium area, 3.5 mi. southwest of Gunnar Gold.

★**National Explorations Ltd.,** Vancouver, B. C., has purchased the "soc" group of seven claims 1.5 mi. northeast of the main Gunnar Gold uranium property, St. Mary's Channel area, Lake Athabasca.

IN THE PHILIPPINES

★**United Paracale,** Marsman-operated gold mine in the Paracale field, announced a shut-down effective April 11, blaming its poor financial condition caused by the effects of the minimum wage law, the indemnity payments called for as a result of the mine disaster in which 56 miners lost their lives last December, and failure to develop enough ore to run the mill at full capacity. Operations at the Longos and McDonald sections of the mine have proven insufficient to permit mining 8-10,000 tons a month. The shut-down is for an indefinite period and has been authorized by the Court of Industrial Relations. Miners and other personnel will be offered jobs so far as possible at San Mauricio, also operated by Marsman & Company.

★The annual report of **Lepanto Consolidated** for 1952 disclosed that 377,276 tons of copper-gold ore were milled during the year averaging 3.9% copper, 0.125 oz. gold per ton. The total copper production was 27,416,290

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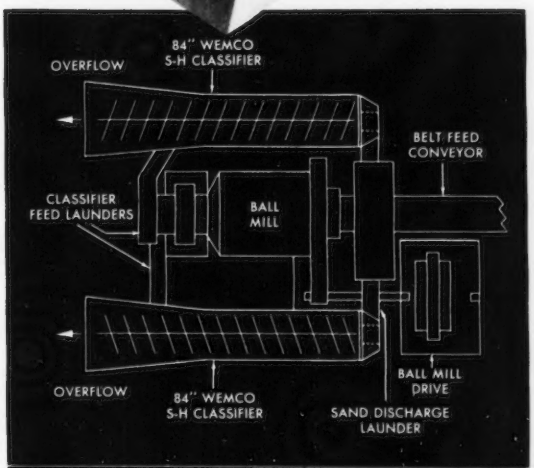

- As shown in the accompanying diagram, two Wemco S-H Classifiers will be operated in closed circuit with each of six ball mills, 12' 6" x 13' in size. The minerals to be produced are chalcocite and minor amounts of native copper occurring in sandstone and shale deposits. Each classifier is of the submerged spiral type of design with 84" double ribbon, variable pitch spiral. Inside tank length totals 41' 9". Operating slope is 3½" per foot.

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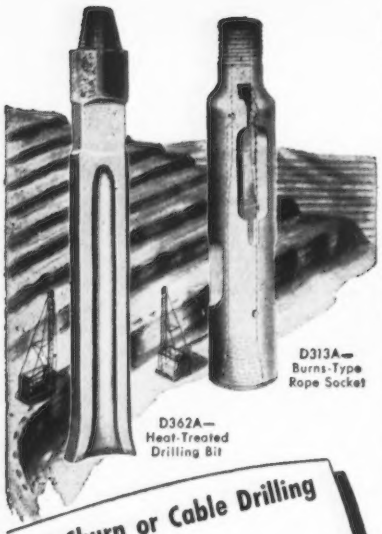

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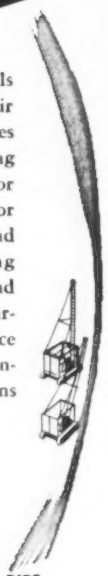
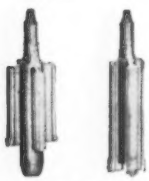


D606—Reamer-Type Pilot Bit



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Philippines *(Continued)*

lb., with by-product gold totalling 37,699 oz. and 178,419 oz. of silver. The gross value of the production was 21.4-million pesos ($10,700,000).

Under an arrangement with American Smelting & Refining Company two-thirds of the copper recovered from the shipments was returned to the company for sale which permitted realization of an overall price of 36c. per pound. The total direct operating cost per pound of copper produced was 37.1 centavos ($0.185) before credit for gold and silver. If the latter were credited against operating cost, the cost per pound copper was reduced to about 23 centavos ($0.115).

Ore reserves at the end of the year were 2,331,905 tons averaging 4.13% copper and 0.128 oz. gold per ton. Ore reserves increased 6% over 1951, over six years' supply at current milling rate.

★The table on page 166 shows **production of the principal Philippine gold mines** for March, 1953, compared to March, 1952, with value at the statutory price in both instances.

IN LATIN AMERICA

BOLIVIA

★**Bolivia, largest Western Hemisphere producer of tin,** plans to establish its own tin smelting industry, according to a United Nations release. One of the most serious problems facing this development, however, is the lack of power close to the area where the tin is produced. It is therefore planned to develop hydro-electric power on the Ibirisu River and transmit it over long distance lines to Oruro. Lack of coal is another serious problem, and here it has been suggested that the plant employ "a low temperature hydrogen reduction smelter." UN experts claim that hydrogen is just as good as carbon for a reducing agent. The Government is erecting a pilot smelter at LaPaz using the hydrogen reduction principle. Alfred M. Bemmett, electrical and civil engineer from London, is undertaking a study of some of the major technical problems facing this domestic tin smelter.

★**The Bolivian Government** has announced an agreement under which U. S. purchases of tungsten ore will be made through the General Services Administration at a price of $63 per short ton unit of WO_3. (World price was about $40 to $42 in May.) Of this amount, the Patiño interests will receive $10 per unit against future indemnization by the Government for nationalization, and an additional $10 per unit will be set aside to pay off a loan from Export-Import Bank for development of Bolivian wolfram.

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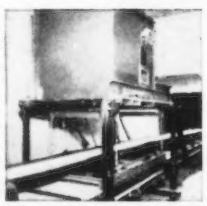

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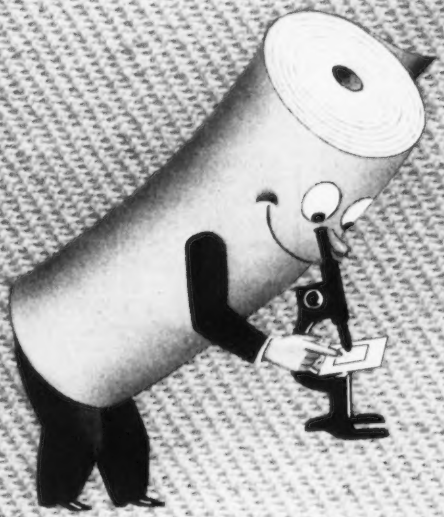

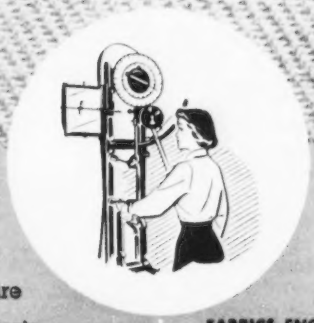

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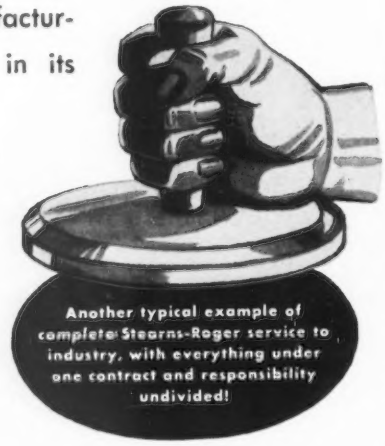

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CHILE

★**Chilean economists are worried** because of the downward trend in the price of copper. Chile has been selling the copper produced by the American companies at 35½c f.o.b. Chilean ports, and paying 24½c for the same copper since May, 1952.

★The government will spend 45-million pesos this year on the **Antofagasta Mining School,** which at the present rate of exchange means U.S. $410,000. It is planned to spend a total sum of U.S. $1,100,000 on the Antofagasta School of Mines in the next three years, so that the school will be able to take in a total of 1,000 students who will come from the provinces of Tarapacá and Antofagasta.

★**According to the Chilean Mining Code,** mining claims are held, after they have been surveyed, by the annual payment of a small sum of money which goes to the Municipalities. Recently a law was enacted raising the value of this sum many times. The Mining Associations have protested against this measure, and recently Congress repealed it by a large majority. In Chile no development work has to be done by the owner to hold a claim as long as he pays his tax.

★**Output of sulphur has been reduced appreciably** in Chile since the price of sulphur began to come down in the European and Latin American markets. Chile is a large potential producer of sulphur, but its costs are high because all the sulphur mines are located at above 13,000-ft. altitude and at considerable distances from the coast.

★**A strike that had lasted** about two weeks during March and which had affected about 1,100 workers at Chuquicamata and stopped production completely, was finally settled. The men obtained bonuses which varied between 15 and 30 pesos per day per man.

★**The new increase in wages** obtained by the coal miners, which amounted to a rise in pay of 60%, has compelled the coal companies to increase the price of lump coal by 660 pesos or six dollars per metric ton.

★**Robert E. Dwyer,** president of Anaconda Copper Mining Co., who came to Chile to be present at the inauguration of the sulphide plant at Chuquicamata and to discuss with the Chilean government the fixation of the buying price for copper at 24½c. to be sold by the Central Bank on behalf of the State at 35½c. f.o.b. Chilean ports, returned to the States by plane in April. However, Roy H. Glover, Anaconda's vice president and chief counsel, remains in Chile to carry on the discussions with resident vice president R. Michels. Just before leaving, Mr. Dwyer gave the local press a very interesting interview, in which he commented on the enormous development of the copper industry during the half century he had been con-

nected with Anaconda. He mentioned the close relationship which had arisen between the country's economy and the copper industry. Mr. Dwyer also remarked that neither Anaconda nor Braden nor any of its subsidiaries had any financial connection with the African copper mines. He referred to the very low rate of exchange (19.37 pesos to the dollar) which the government allows the American copper companies operating in Chile; this discriminatory rate of exchange makes labor, supplies, food, freight and everything bought within the country extremely expensive, as the free banking rate is at the present time 110 pesos to the dollar. Another indirect tax, recently placed on the Chilean (American) producers, continued Mr. Dwyer, is the 23.854c. per pound limit placed on the price which they can receive for their copper, though such copper is currently sold by the government at 35½c. per pound f.o.b. Chilean ports. He contrasted such a policy with that followed in other copper producing countries, where the companies receive the whole value of the sale price of copper and are taxed on their profits.

GUATEMALA

★**A new concentration plant** has just been installed by Compania Minera, S.A., which is producing lead and zinc at a mine near Coban in northern Guatemala. According to Ben Johnson, general manager, the new plant represents an investment of about $200,000, and raises the total investment in the mining project to about $1.5-million. Capacity of the plant is about 150 tons daily. High cost of transporting crude ore to Puerto Barrios for shipment to the U. S. has made the new concentration plant an economic necessity. Concentrates shipped to the coast run about 65% lead and 14% zinc. All lead-zinc ores carry traces of silver.

MEXICO

★**Pending increases in U. S. import duties** on metal have so worried the Mexican Mining Chamber that it has asked the Foreign Relations Ministry to exert its influence to discourage this tariff bill. The tariff would be regarded as a stiff "body blow" to Mexican mining. Further reduced lead and zinc sales to the U. S. (which would result if the tariff bill in U. S. passes) would result in a detrimental effect on 68.77% of Mexico's mine output. If the U. S. proposed tariffs are imposed, Mexican mining men anticipate the closing of 36 mines and the lay-off of 40,000 miners as a result.

★**The Mexican Mining Chamber** advocates that five-year tax-exempt provisions for new industries be extended to new mines, and to plants resuming work on mining properties.

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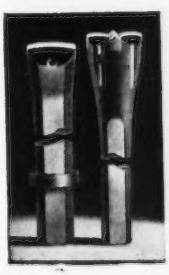

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Latin America *(Continued)*

★**A large tract of sulphur** of high purity was located at Tellepan, S.A., by an American firm near Coatzacoalcos, Vera Cruz gulf coast oil and railroad center. This deposit was discovered some years ago, but kept secret by Mexican Eagle, one of the expropriated foreign oil companies. Tellepan has asked for a franchise to work on this deposit.

★**The iron industry** had to lay off more than 3,000 workmen during the past five months because of reduced business and less credit. Mexico's 20 iron mills are currently working at half capacity, and monthly production is down to 8,000 to 10,000 tons of metal.

★**Because of no market** in Mexico, 250,000 tons of quality iron ore mined in Picila must be sold to the U. S. Delivery and will be at the rate of 10,000 tons every 20 days through the port of Manzanillo.

★**Mexico's mine output** in metric tons was as follows for 1952:

Product	Tons
Gold	14,289.224
Silver	1,566.171(*)
Copper	58,462.954
Lead	246,027.000
Zinc	227,375.000
Iron	336,838.000
Manganese	45,002.0
Antimony	5,531.0
Mercury	301.0
Graphite	24,153.0
Tungsten	287.0
Arsenic	2,865.0
Cadmium	734.0
Tin	419.0
Cobalt	16.0

(*) 45.5 million oz.

PERU

★**Projected import duties** to be charged by the United States against foreign production of lead and zinc imported by the United States have caused serious concern among mining men in Peru. If duties mentioned in recent U. S. news reports were to be imposed, the Peruvian mining industry would receive a tremendous shock which might paralyze the domestic mining industry. As much as 35% of the total exports of Peruvian industry come from the sale of lead and zinc metals.

At present prices, many of the lead-zinc producers are just at the break-even point, and some operations have started to shut down. Zinc is stored in many operations, because it is not profitable to market at present prices.

It is feared locally that if the U. S. imports duties as projected were imposed, many projects involving large financial expenditures would have to be deferred, including sums for concentrators, refineries, and fairly large hydro-electric projects. The loss of

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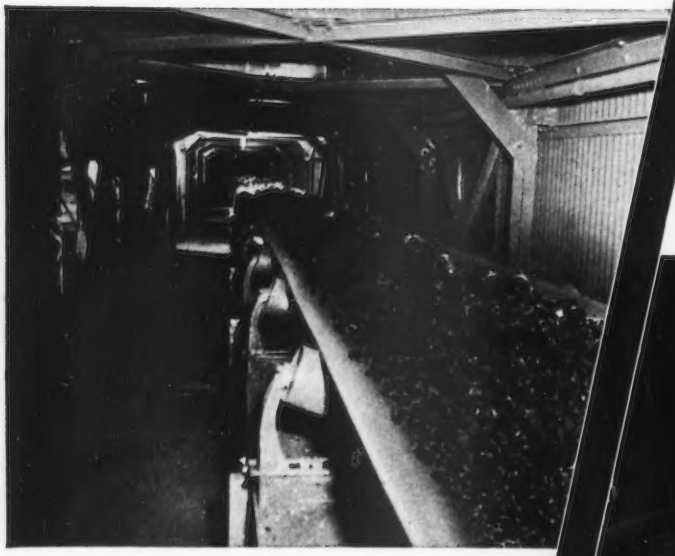

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dollar revenue might cause serious inflation in the Peruvian economy.

The general point of view is that Peru has increased its lead-zinc production heavily to help the Democracies win the war, and that an act by the United States suddenly cutting off requirements for this production would be regarded as unfriendly.

★**The first lot of 10,000 tons of iron ore** was exported to the United States on April 30 by the Marcona Iron project in Southern Peru. It is expected that the rate of production will be of the order of 2-million tons per year, of which a sizable amount would be used for Peruvian iron production when the country's iron smelter is completed—reportedly within the next few years.

IN EUROPE

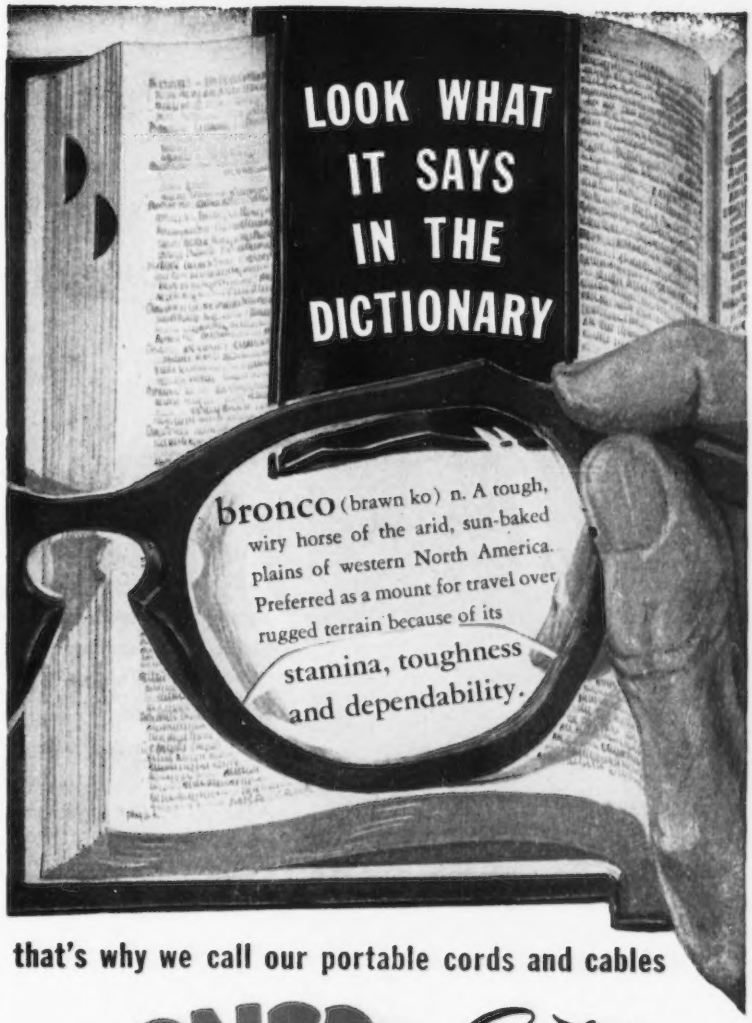
★**Experts of the Bor copper mine** say that it is far from reaching the end of production. They estimate remaining reserves at around 70-million tons of copper ore. However, content is considerably lower than in the veins exploited hitherto. It is put at 1.24% against 5.04%, on average.

The experts have put forward plans for a more rational exploitation of the by-products of the copper refinery. They claim that over 50,000 tons of sulphur per year could be recovered, and point out that some 350,000 tons of slag are discarded each year although this contains about 25% of iron.

★**Resumption of trading in copper** on the London Metal Exchange on August 5 is viewed with a great deal of concern by metal buyers all over the world, particularly because of the depressing effect the resumption of trading in lead and zinc had on such markets. There is serious concern over the estimated 200,000 tons of copper which the Ministry of Materials will have on hand when free trading is resumed. British advices claim that experience gained in the freeing of lead and zinc to trading on the Exchange should preclude any danger of Government dumping on the market, particularly because of the importance of such holdings of copper to Britain's defense position.

IN AFRICA

★**A vast air and ground search** for strategic minerals—covering 25,000 square miles in northern Mozambique and 40,000 square miles in eastern and western Angola—is getting under way this month. The complete air photo coverage of the areas will be made by Aero Service Corp. of Philadelphia; the ground geologic work is being performed by a Minneapolis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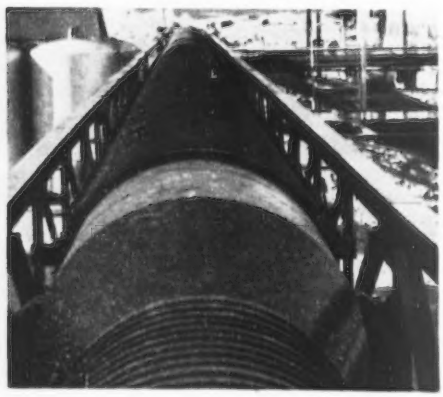
EFFICIENCY OF WOOD STAVE PIPE FOR MINING WASTE DISPOSAL OBSERVED IN SANTA FE INSTALLATIONS

MOUNTAIN IRON, MINNESOTA... 8500 lineal feet of machine banded, wood stave pipe was supplied by the Santa Fe Tank & Tower Company, Los Angeles, for disposal of *mine tailings* in the Mountain Iron region. This pipe line has an inside diameter of 8 inches, and carries the tailings a considerable distance to a disposal area. Actually, wood stave pipe is made to measure from 2 *inches* to 20 *feet* in diameter. Such installations are being extensively used at mining operations throughout the world for carrying water, chemical solutions, etc.

The popular use of wood stave pipe in mining installations has a number of very definite advantages, according to Santa Fe engineers. Aside from its natural *economy*, wood pipe is not affected by corrosion. Its large *flow* capacity does not decrease with age, nor is it affected by electrolysis. Wood stave pipe neither expands nor contracts in varying high and low temperatures, and therefore does not require costly expansion joints necessary with other types of pipe.



Wood stave pipe has proven to be most efficient for *tailings disposal*, particularly, because it offers a *hard* wearing surface to abrasive materials. It's easy to install and requires little maintenance.

Santa Fe plant facilities and inventory are among the largest for this specialized type of wood pipe construction. Branch offices are maintained in all principal cities. For complete information and engineering data on Wood Pipe, Cooling Towers, Cylindrical Gas Scrubbers, and other industrial wood specialties, write Santa Fe Tank & Tower Company, 5401 S. Boyle Ave., Los Angeles 58, Calif.

Africa *(Continued)*

firm, the E. J. Longyear Co. Costs of the survey will be shared by the American and Portuguese Governments.

A series of overlapping air photos are being made of the areas of interest, from a height of about 25,000 feet. Each photo covers an area of about 35 sq. mi. The photos will be studied stereoscopically to gain geologic data. Geologists find that important information often can be obtained from air photos in areas where brush or overburden may obscure geologic features for ground parties.

★**France has made her first** move toward exploitation of the resources of the Sahara Desert. At an inter-ministerial council held by the French Premier M. Rene Mayer, with M. Roger Leonard, Governor General of Algeria, General Guillaume, Resident General of Morocco, and M. Erik Labonne of the French Overseas Union, it was decided to begin immediate development of the area south of Colom Bechar, on the fringe of the Sahara. Vast amounts of coal, iron, copper, manganese and petroleum have been located in this portion of the Sahara. It is planned to establish a giant industrial center for treatment of this mineral wealth.

★**Invitations to smuggle diamonds** to America by post have been received by South African firms in letters purporting to come from an import-export house with a Wall St. address. It states, "Dealing in this kind of business is very simple, as shipments are light and can easily be concealed in any letter or small package. In the U. S. rough diamonds are free from duty, and if you send by airmail, you will receive your money in ten days in any currency you desire. You may send them under any name or initial you may prefer . . ." South African police are cooperating with New York officials in tracking down this proposed practice, since it is a serious offense to deal in diamonds without a license in South Africa.

★**One of the world's largest tin producers,** Billiton Co. of Holland, may start mining activities in the Union of South Africa. Two of the company's officials are studying ore deposits here.

★**Pyrochlore,** a mineral rich in tantalum and columbium, has been discovered in Northern Rhodesia.

★**South Africa's second plant** to recover uranium from gold ore residues is now operating at Daggafontein G.M. on the East Rand.

★**A new high value** of 982 in.-dwt. has been picked up in a borehole at a depth of 2,900 ft. on Merriespruit G.M. in the Orange Free State. Until now values have been on the low side, but it was considered that the shallowness of the reef in the area would offset this. Underground development is to start shortly.

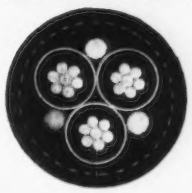
★**Asbestos** has now become Southern

Underwater operation holds no peril for these Hazacord cables. Skid mounted junction box contains four 400 amp. circuit breakers . . . single cable leads from transformer bank; four branch circuits go to the control house near the shovel (below). The 500 horsepower motor which operates the pit-pump used for pumping the phosphate-bearing matrix to the washer also gets its power through Hazacords.

Grabbing 17 yards of phosphate rock in a single bite, this enormous dragline supplies raw material for fertilizers and chemicals produced by the Virginia-Carolina Chemical Corporation. Power is furnished by thousands of feet of Type SH-D, 5000-volt Hazacord cable.

Hazard's exclusive ZBF sheath—cured under pressure in a continuous metal mold—is one reason why Hazacord cable can take the rough treatment it gets being dragged over this rugged Florida terrain.

V-C CHEMICALS SELECTS LONG-LIVED HAZACORD SHOVEL CABLES FOR RUGGED PHOSPHATE MINING OPERATION



Hazacord Type SH-D was used exclusively by V-C for this important mining job. The safest and most widely used type for high-voltage work, Hazacord Type SH-D has copper shielding braid over each insulated conductor . . . grounding conductors in the interstices. For use up to 15000 volts.

On *every* job . . . from a giant dragline to a portable electric saw, Hazacords are setting new standards for long, economical service from cords and cables. Get complete information from your Hazard representative, your jobber or write to us today. Hazard Insulated Wire Works, Division of The Okonite Company, Wilkes-Barre, Pennsylvania.

HAZACORD Mold-Cured portable cables

1403

SAFETY LESSON #1
A STEEL CHAIN REPAIRED WITH A MALLEABLE LINK BECOMES A MALLEABLE CHAIN.
A STEEL CHAIN REPAIRED WITH LAUGHLIN'S DROP FORGED STEEL "MISSING LINKS" BECOMES STRONGER THAN BEFORE

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"MISSING LINKS"

REPAIR CHAINS BETTER

"MISSING LINKS"

MATCHED

Made with special dies so that each half is pressure fitted. This eliminates play between the forgings, insures perfect fit when riveted into chain. There is no strain on the rivets.

INTERLOCKING LUGS

More costly to put in the dies, but they grip firmer and really do the work of taking the load.

ORDINARY LINKS

UNMATCHED

When loose fitting links are put into a chain and the load is applied, the rivets take most of the strain and tend to shear until the links set. This may later cause the link to open up under heavy load.

ROUND LUGS

Ordinary round lugs fitting into round holes don't have the holding power, tend to shear or force out under strain.

Laughlin "Missing Links" are made of carefully heat treated, high grade steel. They have features found in no other repair links, and are also supplied in an exclusive pear shaped design in sizes for 3/8" to 1 1/8" chain.

Buy From Your Local Distributor

He is in business to give you prompt, courteous service and to save you money, time and trouble. He's your one best source for industrial supplies.

FOR SAFETY'S SAKE SAY LAUGHLIN

THE THOMAS LAUGHLIN CO.
66 Fore St., Portland, Me.

*T. M. Reg.

Africa *(Continued)*

Rhodesia's most valuable mineral product, having ousted gold from this position. The value of the 1952 output was more than $24-million. This, together with the $6.5-million now being spent on the new holdings of Rhodesian Asbestos, Ltd., suggests that asbestos may become the basis of the country's economy. Others interested in the Mashsba deposits are British Metal Corp., Anglo-Huronian, and Simon I. Patino interests.

★**Arrangements have been approved** between French mining companies and U. S. Steel Corp. providing for research and mining of manganese in Gabon, French Equatorial Africa. The deposit is said to be one of the world's richest, containing 40 to 50% manganese. Reserves are estimated to be 50-million tons.

★**A 238-million franc credit** is to be granted to the Algerian mining company, Société des Mines de Sidi Kaber, by the U. S. Defense Materials Procurement Agency, which will be used to equip the company's lead mine. Reimbursement will be in the form of lead ore delivered to the U. S. agency.

★**Concern is being felt** in South Africa over the fact that despite continuation of strict import control, the gap in S.A.-U.S.A. balance of trade is widening once again. This gap has to be met by shipments of gold.

The pattern briefly is as follows;

	Exports to U. S.*	Imports from U. S.*	Gap
1945	38	127	89
1946	56	170	114
1948	28	380	352
1949	70	180	110
1950	70	127	57
1951	85	240	155
1952	56	252	196

* (In millions of dollars.)

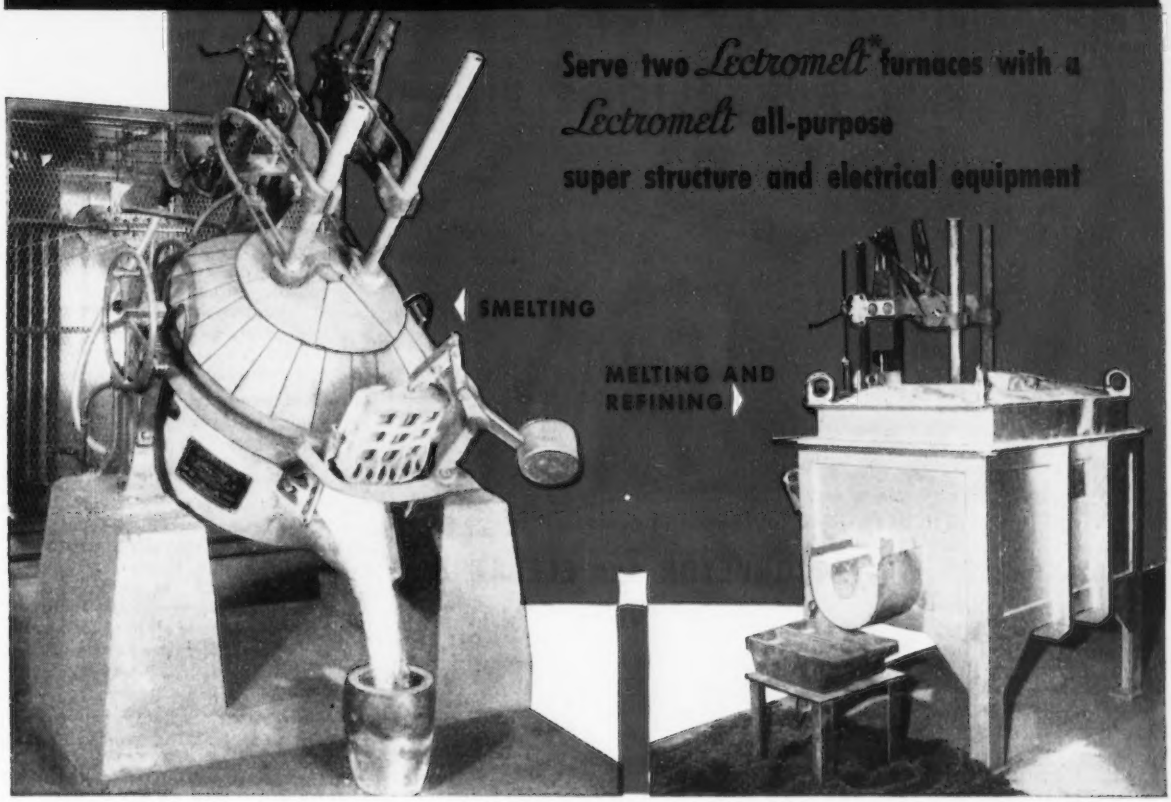
The future is largely dependent upon whether or not the gap can be kept within control until uranium production builds up its dollar earning capacity over the next few years to around $85-million a year and until the new mines get into production.

IN AUSTRALIA

★**Low gold prices on the world's free markets** have affected exports of Australian gold, and several mine operators are becoming concerned about difficulties in meeting high operating costs. Wage rates in Australia are again swinging upward, and the manpower situation is again becoming somewhat tighter.

★**Dropping tungsten prices** have not affected Australian producers who in many instances have contracted to supply their entire output at a minimum price exceeding present world

Save money in outfitting your laboratory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SMELTING
MELTING AND REFINING

With these two furnace shells and the one Lectromelt superstructure, your laboratory can handle almost any problem having to do with electric furnace operations. The superstructure can be shifted from one furnace to the other, as required, along with its electrical equipment.

The combination at the left is designed for small scale, batch smelting of ores and concentrates, melting of non-metallics, melting and refining of metallics. The furnace at the right can be used for continuous operations in experimenting on the reduction of ores and melting of non-metallics.

Both furnaces can be employed with direct and indirect arcs. 50 KVA of power is available on low voltages and 100 KVA on high voltages.

Lectromelt engineers have been conducting continuing research for many years on electrothermic reductions, so they can help you put these laboratory furnaces to work proving new processes or improving the old ones. For Catalog No. 104 telling you about this service, write Pittsburgh Lectromelt Furnace Corp., 322 32nd Street, Pittsburgh 30, Pa.

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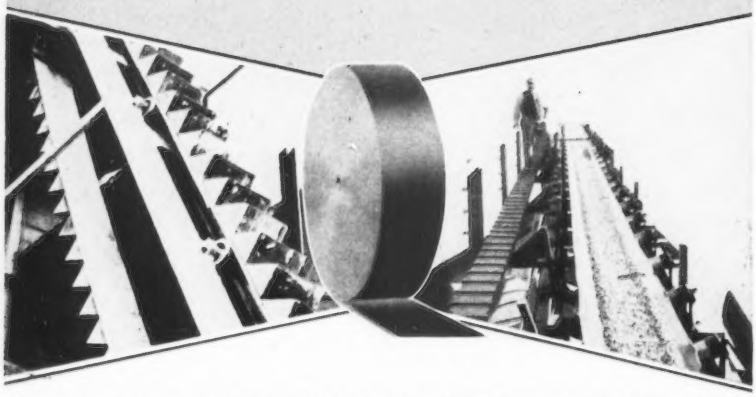
*REG. T. M. U. S. PAT. OFF.

WHEN YOU MELT... MOORE RAPID *Lectromelt*

Actual facts about big Economies for you with Dependable REPUBLIC BELTING



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No excess sagging even under heaviest loads. Pre-stretched Republic Belting prevents slippage, reduces pulley cover wear.

THEY'RE MILDEW-PROOFED

Yes, and weatherized too! With special cover compounds that stand up under the hottest suns and coldest skies. Special processed fabrics keep carcasses safe from rot, mildew, decay.

THEY'RE PROTECTED, *Plus!*

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INDUSTRIAL RUBBER PRODUCTS

Australia *(Continued)*

prices. The contract between King Island Scheelite and the U. S. Government terminates in December 1957. However, expansion plans have been postponed and some equipment ordered abroad will not be purchased.

★**For the first time** since the war, Australia will have ample copper supplies of her own, with something left over for export.

★**At present many purchases of capital equipment** for the mining industry are being purchased in view of the expectation that a special 40% depreciation measure will be reinstated in the next financial year (starting July 1953). Circles close to Government believe that at least half of this depreciation allowance would be restored, and there is no doubt of the possible effects of such a step on the demand for capital equipment for mining and metallurgical industries.

★**To encourage private prospecting** and mining of uranium, the Australian Atomic Energy Commission is developing a set of special incentives which include a higher price to be paid for uranium. Long-term contracts for purchase of uranium will be concluded, although the Federal Government would be the only purchaser of uranium. Rewards will be paid for new discoveries of uranium, and there is a provision for additional rewards should the economic importance of the new discoveries be enhanced by later developments.

★**Western Australian manganese producers** have received permission to export 8,000 tons of crude manganese to the United States. Shipments will commence late in August, 1953. Permission was granted after three years' efforts to obtain an export permit, and it is believed that a U. S. market for Australian manganese can now be developed.

★**Blue Spec's No. 1** winze from No. 4 level continues to go down in rich gold and antimony values. Latest reports suggest average values of 61.6 dwt. gold a ton and 11.8% antimony. The combined value of gold, antimony and tungsten in the company's ore, makes the mine one of Australia's richest, but transportation difficulties are a serious problem.

★**Good yields have been reported** by Norseman Gold Mines N.L. and by Hill 50 Gold Mine N.L. whose latest four-week effort resulted in a treatment of 6,840 tons of ore for 2,370 oz. of gold.

★**Whippet Consolidated N.L.** is to continue the development program to open up the lode preparatory to stoping. Tin was struck in its shaft recently.

★**Peko Gold Mines N.L.** reports good copper values in its east drive with values of up to 21.7%, but ore from its west drive assayed only low values of copper and gold. The company proposes to raise funds by an issue

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"Mining's Greatest Era"

A PANORAMA OF MINING'S GREATEST EXPANSION PROGRAM

Read it from cover to cover.

DON'T MISS . . .

This authoritative, graphic, pictorial panorama of mining's greatest expansion program—which now adds up to an investment of more than $2-billion, over the next four to five years. This section will include:

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An up-to-date report on new mining projects, domestic and foreign, with the latest on taconite production.

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A heavily illustrated report on new mining and metallurgical projects, all over the world, with special emphasis on new techniques of mechanized mining and low-cost processing.

ALUMINUM

A graphic presentation of the tremendous growth in productive capacity.

Make plans now to hold on to your copy. Don't let it get away from you. You will want to refer to the editorial contents and advertisements in the July issue of E&MJ for years to come.

URANIUM, MOLYBDENUM, TITANIUM, COBALT, NICKEL

An exciting report on the new projects now beginning to expand the production of these vital metals. The variety and quantity of new, even revolutionary, techniques will be covered in considerable detail.

NONMETALLICS

Details of the growing nonmetallics field, highlighted by the new projects in potash, sulphur and phosphate rock.

A COMPREHENSIVE SURVEY of the great opportunities that lie ahead for metals like magnesium, titanium, cobalt, germanium and certain "new" nonmetallics.

AN AUTHORITATIVE ANALYSIS of the outlook over the next few years for the big production minerals – aluminum, iron ore, copper, lead, zinc and potash.

In addition, the July issue of E&MJ will contain the regular editorial features...

PLUS An outstanding display of advertisements prepared for you by the companies serving your industry. They will show you how their products are contributing or can contribute to your industry's greatest expansion program.

The July issue will give you for the first time a full perspective of the

★ impact of significant new technology in mining and metallurgical processes

★ impact of the important world-wide metal and nonmetallic mineral industry expansion programs

★ impact of important individual company expansion programs—*not only on your industry and its future but—more important—on you and your future.*

Many mining companies have indicated that they will want extra copies of this issue. If you want copies of E&MJ's July issue, "Mining's Greatest Era," write to the Editor of ENGINEERING AND MINING JOURNAL, 330 West 42nd Street, New York 36, New York, now and reserve your copies. Only a limited supply is available. Price per copy is $1.00 in United States, U.S. Possessions and Canada; other countries, $1.50.

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In every industry, from ore to fabric to steel, Buell engineers, working with plant engineers, have established an enviable 18-year record of turning unnecessary dust losses into substantial new profits. What's more, a Buell Dust Recovery System uncovers these additional important advantages: improved product quality, smoother plant-community relations and higher employee morale.

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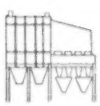
Van Tongeren Cyclone

'SF' Electric Precipitator



Precipitator-Cyclone Combination

Type 'LR' Collector

Dust Hopper Valves

ELECTRIC CYCLONIC

buell

ENGINEERED EFFICIENCY IN DUST RECOVERY

Asia *(Continued)*

of stock, having rejected a Canadian offer of financial assistance because of unsatisfactory conditions of the proposal.

IN ASIA

★**The Government of India** is starting construction of a $1,750,000 silver refinery at Calcutta. Primarily intended to extract silver (an estimated 23-million oz. yearly) from quaternary coins, since replaced by nickel, the plant will also produce 3,600 tons of electrolytic copper as a by-product. The Government hopes to save $400,000 a year once the plant is operating.

The contract for building the silver refinery has gone to the German firm of DEMAG of Karlsruhe, Germany. The German company obtained the contract because it offered to do the job at lower cost than British firms, also because a new electrolytic process will be incorporated by the German builders.

★**A $350,000 pilot plant** for the smelting of iron ore by the low-shaft furnace process without the use of coking coal has been approved by the Government of India's Council for Scientific and Industrial Research. The project, which aims to enable India's iron and steel industry to expand in areas where coking coal is not available, will be carried out by the Fuel Research Institute at Dhanbad.

The decision is linked with discussions recently concluded between representatives of the Indian iron and steel industry, the World Bank and Koppers, Inc., over a new $160-million iron and steel plant. The report now pending with the Government is believed to recommend extension of the Tata Iron & Steel Co. plant at Jamshedpur (instead of a new $160-million plant) by means of a loan of $85-million, part of which would presumably come from the World Bank. The aim is to boost India's steel production from its present 1¼-million-ton capacity to 2¾-million tons.

★Britain, paying in sterling, has outbid the United States, which would have paid dollars, **for 100 tons of silver** offered by the Japanese authorities.

A hundred tons equals more than 3-million oz. Initially Japan offered the lot for public tender in dollars, but she rejected the dollar bid. Bullion traders learned today that Britain bought it last week-end for about £1-million sterling.

It is understood that the silver will go to augment Britain's internal supply and will not be offered on the international market. In some respects the transaction is a unique one for post-war Britain. The British authorities must have been influenced by the consideration that the payment will help to relieve Japan's present shortage of sterling.

NEW BOOKS

(*Continued from page 115*)

Mesa Miracle. The story of the Colorado Plateau's fast-growing uranium industry is told exceptionally well in this 36-page handsomely-illustrated booklet prepared by United States Vanadium Co., a Division of Union Carbide and Carbon Corp. The booklet pays tribute in text and illustrations to the thousands of people in the area who are taking part in the important uranium-mining phase of the nation's atomic energy program. For copies of the booklet, write to: United States Vanadium Co., Room 308, 30 East 42 St., New York 17, N. Y.

Bibliography and Index of Published Literature on Uranium and Thorium and Radioactive Occurrences in the United States. Part 1: Arizona, Nevada, and New Mexico. By Margaret Cooper, Division of Raw Materials, U. S. Atomic Energy Commission. Published by the Geological Society of America, 419 West 117 St., New York 27, N. Y. Pp. 38. Price 25¢.

A Study of Size of Diamonds in Diamond Drilling. By Robert J. M. Miller, instructor in mining engineering, Missouri School of Mines and Metallurgy. A very scholarly and useful contribution to the somewhat limited information on this subject. Published by the Missouri School of Mines and Metallurgy, Rolla, Mo., as Bulletin No. 81 of a Technical Series. Pp. 63.

Foundation Engineering. By Ralph B. Peck, research professor of soil mechanics, University of Illinois; Walter E. Hanson, engineer of bridge and traffic structures, Illinois Division of Highways; and Thomas H. Thornburn, research associate professor of civil engineering, University of Illinois. This book covers the theoretical and practical aspects of soil mechanics in four parts: (A) Basic soil mechanics, (B) descriptive matter concerning foundation practice, (C) methods training the reader to select the most appropriate foundation for whatever subsurface conditions are encountered, and (D) elements of structural design commonly used for foundations and retaining structures. Published by John Wiley & Sons, Inc. 440 Fourth Ave., New York 16, N. Y. Pp. 410. Price $6.75.

Geology of the Caballo Mountains. By Vincent C. Kelley and Caswell Silver. A detailed geological study of the Caballo Mountains, situated about 60 mi. east of Silver City, New Mexico (Major town in the area described is Truth or Consequences, N. M.). Although not heavily mineralized, gold deposits in the area are described as being "of considerable importance," and fluorspar potentialities are reported to be good. Possibilities for gas

Athey SIDE DUMP TRAILERS

CHOSEN BY LARGE CEMENT PLANT

• The Marquette Cement Manufacturing Company have standardized on Athey PD-20 Side Dump Rock Trailers teamed with Caterpillar DW20 Tractors for hauling overburden at their big Oglesby, Ill. plant. These husky units haul heavy 4000-lb. per yard material, a mixture of shale and dirt, at high speeds. Furthermore, they know they can count on these rugged units to work year around, often 16 hours per day.

• On this typical overburden hauling job, the Side Dump Athey PD-20's save backing and separate hoisting operations by dumping on the fly over the edge of the fill, while the DW-20 — PD20 unit is still rolling forward safely at 8 m.p.h. The units average 250 tons hauled per hour or about 125 pay yards. The 3-1/2 yard shovel loads the trailer in 2.5 minutes. Then, the Cat DW20 pulls the loaded Athey PD-20 Trailer 3300 feet at an average speed of 10.3 m.p.h. including 800 feet of 8% adverse grade in 2.5 minutes. The "on-the-fly" dump takes less than half a minute; return of 2100 feet — with 350 feet of 15% down hill grade — requires 1.5 minutes for an average speed of 16 m.p.h.

• Athey PD-20 - Cat DW20 owners everywhere like this rugged high speed hauling. They are fast, with haul speeds up to 26.6 m.p.h., and have positive and safe air brakes on tractor and trailer. Positive six-wheel suspension makes fast, safe dumping without stopping at the edge of fill. The Athey PD-20 Trailer is designed to stand up on the toughest rock jobs. The high-tensile steel, all welded body presents a big loading target and is rugged enough to take lip loading of large rocks. The 29-cubic yard, 30-ton capacity makes an economical unit where big production is needed.

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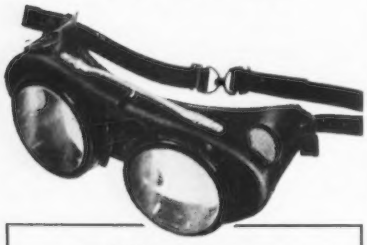

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Fit easily over modern prescription glasses—use standard 50 mm. round lenses.

They offer many benefits to workers in hazardous occupations—

improved design . . . provides snug, comfortable fit—ample room over modern large-frame prescription glasses.

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New Books *(Continued)*

and oil exist in the adjacent sediments. Published by The University of New Mexico, Albuquerque, N. M. Pp. 286 plus maps and sections. Price $2.50.

Erzmikroskopisches Praktikum. By Hans Schneiderhöhn. Published in German by E. Schweizerbart'sche Verlagsbuchhandlung, Stuttgart-W, Johannes Strasse 3/I, Germany. Pp. 284; pls. 32; figs. 113; tables 39. A comprehensive, thorough, and up-to-date work on ore microscopy by the well-known author of mineralography. Commencing with the chronological development of the use of the ore microscope, the new volume covers in 12 parts or chapters the entire field of ore microscopy, new findings and developments. With accent being given to practical problems, the book should prove most useful to university students and to those wishing to master the subject of ore microscopy by self study. Part 1 entitled Erzmikroskopische Apparaturen gives an historical review of the use of the ore microscope and details of the theory and use of the microscope, camera, and supplementary equipment. The making of polished specimens is covered in part 2, Die Anfertigung von Erzanschliffen. Part 3, Optische Unter suchungsmethoden, discusses in great detail optical properties and their determination. In looking over the bibliography at the end of the volume it will be noted that it is quite international in character. Of the 262 authors mentioned, 120 are German, Austrian, and Swiss, 80 American, 23 French, and the remaining of other nationalities.

The following publications may be obtained from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.:

U. S. Geological Survey Bulletin 988—C, Uranium in the East Walker River, Area, Lyon County, Nev. By M. H. Staatz and H. L. Bauer, Jr. The assay value of samples reported in this bulletin range from .001 to .014% equivalent uranium. Pp. 14, plus maps. Price 35¢.

U. S. Geological Survey Bulletin 989—A, Geology of Buldir Island Aleutian Islands, Alaska. By Robert R. Coats. Buldir Island is a tiny dot in the Aleutians near Attu. Pp. 26. Price 25¢.

U. S. Geological Survey Bulletin 988—D, Distribution of Uranium in Rich Phosphate Beds of the Phosphoria Formation. By M. E. Thompson. Pp. 22. Price 15¢.

U. S. Geological Survey Professional Paper 252, The Hydraulic Geometry of Stream Channels and Some Physiographic Implications. By Luna B. Leopold and Thomas Maddock, Jr. This paper deals with hydraulic characteristics of stream channels — depth, width, velocity, and suspended load. These are measured quantitatively and

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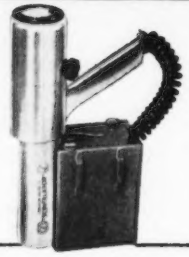

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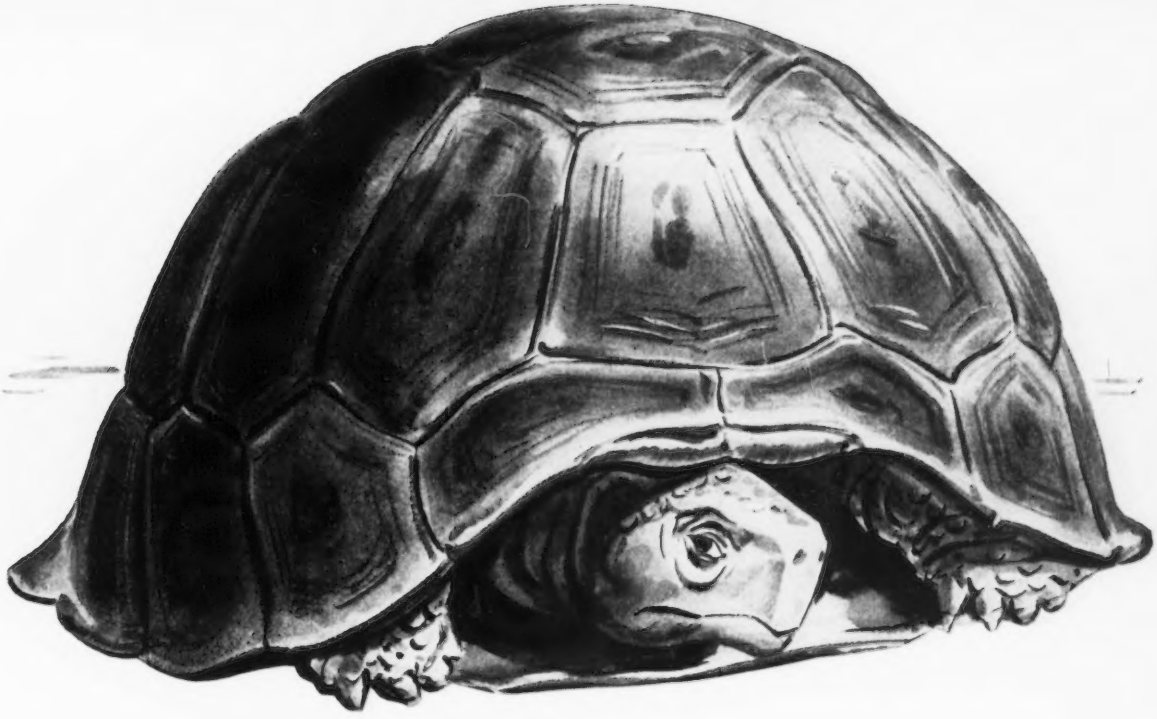

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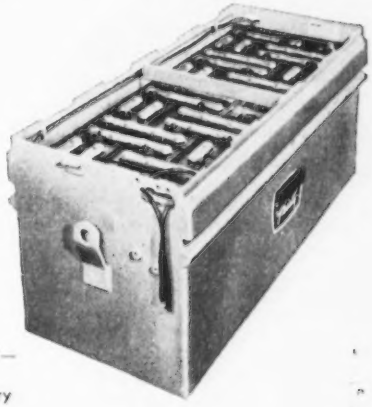

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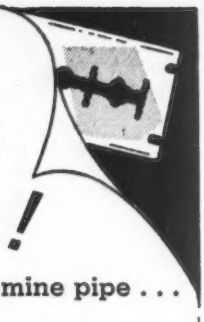

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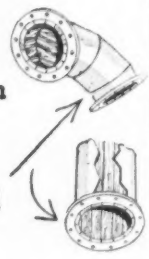

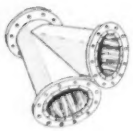

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U. S. Geological Survey Professional Paper 248—C, Mica Deposits of the Southeastern Piedmont. Part 3. Ridgeway-Sandy Ridge District, Virginia and North Carolina. Part 4. Outlying Deposits in Virginia. By Wallace R. Griffitts, Richard H. Jahns, & Richard W. Lemke. Pp. 61 plus maps.

U. S. Geological Survey Professional Paper 248—D, Mica Deposits of the Southeastern Piedmont. Part 5. Shelby-Hickory District North Carolina. Part 6. Outlying Deposits in North Carolina. By Wallace R. Griffitts, and Jerry C. Olson. Pp. 90 plus maps.

U. S. Geological Survey Professional Paper 248—E, Mica Deposits of the Southeastern Piedmont. Part 7. Hartwell District, Georgia, and South Carolina. Part 8. Outlying Deposits in South Carolina. By Wallace R. Griffitts and Jerry C. Olson. Pp. 32 plus maps. Price 50¢.

U. S. Geological Survey Professional Paper 248—F, Mica Deposits of the Southeastern Piedmont. Part 9. Thomaston-Barnesville District, Georgia. Part 10. Outlying Deposits in Georgia. By W. M. Heinrich, Montis R. Klepper, and Richard H. Jahns. Pp. 72 plus maps. Price $1.50.

Configuration of the Bedrock Surface of the District of Columbia and Vicinity. Professional Paper 217. Pp. 42 plus maps. Price $1.25.

Devonian and Mississippian Rocks of Central Arizona. Professional Paper 233-D. Pp. 44 plus illustrations. Price 65¢.

The following reports may be obtained from the U. S. Bureau of Mines Publications Distribution Section, 4800 Forbes St., Pittsburgh, Pa.:

R. I. 4932. Nonmetallic Deposits Accessible to the Alaska Railroad as Possible Sources of Raw Materials for the Construction Industry. By F. A. Rutledge, R. L. Thorne, W. H. Kerns, and J. J. Mulligan. Pp. 129.

R. I. 4945. Processes for Beneficiating Great Gossan Lead Ores, Carroll County, Va. By James S. Browning and Clinton B. Clevenger. Pp. 14 plus flowsheets.

R. I. 4949. Pebble Stoves for Heating Gases to High Temperatures. By R. C. Buehl, J. P. Morris, and J. P. Riott. Pp. 8 plus graphs.

R. I. 4950. Hermada Antimony Deposit Elmore County, Idaho. By Constantine C. Popoff. Pp. 28 plus maps and sections.

R. I. 4951. Ore-Dressing Tests of Aroostook County, Maine, Manganese Ores. By Frank D. Lamb, W. E. Warnke, and D. A. Woodard. Pp. 10.

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I.C. 7637. Successful Use of Wooden Roof Bolts in Stony Point Mine, Stony Point Coal Co., Hopkins County, Ky.

I.C. 7634. Production of Manganese Slags for Manufacturing High-Grade Ferromanganese by Blowing Oxidation Spiegeleisen.

I.C. 7636. List of Respiratory Protective Devices Approved by the Bureau of Mines.

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I.C. 7633. Economic Benefits of Systematic Roof Bolting in Zeigler No. 3 Mine, Bell & Zoller Coal & Mining Co., Williamson County, Ill.

R.I. 4845, Beneficiation of Oxide Manganese Ores from Arapahoe, Douglas, Sagauche, Custer, Chaffee, and Park Counties, Colo. By R. R. Wells, K. C. Vincent, and T. F. Mitchell. Pp. 16.

R.I. 4846. Concentration of Oxide Manganese Ores from San Bernardino County, Calif. By W. W. Agey, S. J. Hussey, and W. J. Long. Pp. 14.

R.I. 4847. Manganese Concentrates from Open-Hearth Slags by Lime-Clinkering (Sylvester) process. By John A. Ruppert. Pp. 26 plus illustrations.

R.I. 4848. Concentration of Oxide Manganese Ores from Vicinity of Winkelman, Pinal County, Ariz. By K. C. Dean, H. D. Snedden, and W. W. Agey. Pp. 21.

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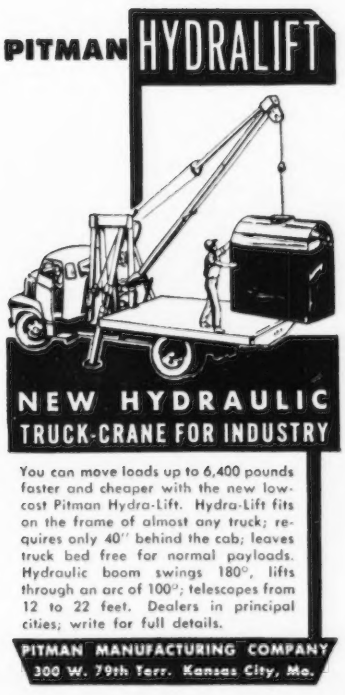
I.C. 7626. Two-Way Radio Communication at Santa Rita Open Pit, Kennecott Copper Corp., Santa Rita, N. Mex.

R.I. 4939. Investigation of the New Anniversary-Bucky Pegmatite, Gunnison County, Colo. Pp. 7 plus map.

(Continued on page 189)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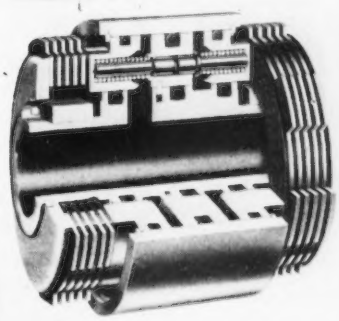
New Books *(Continued)*

RI. 4937. Investigation of Iron Sulphide Deposits in South-Central Aitkin County and Carlton County, Minn. By James Pennington and V. C. Davis.

New Products Digest

(Continued from page 109)



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(Continued on page 190)

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New Products Digest *(Continued)*

A second advantage of the no-adjustment feature of the oil-actuated clutch is that with constant torque capacity assured, it is often possible to use a smaller clutch.

As compared with the conventional mechanically-actuated clutch, the oil-actuated design offers other definite dollar advantages, particularly where remote control is desired. The new oil-actuated clutch design needs only a selector valve and a seal, whereas, the mechanically-actuated clutch requires a throwout fork, operating shaft, hand lever, and a means to grease the throw-out collar.

Complete data, with specific information regarding their use in the mining industry, may be obtained on these equipment items by circling No. 1 on the postage-free reply card opposite page 110.

Boom at Rhyolite

(Continued from page 95)

The main event was the rock-drilling contest. I have forgotten what the purse was, but first money in the double-hand contest went to the Wray brothers, Zeb and Joe. I believe that Zeb afterwards got to be U. S. Marshal at Reno. Second money went to Marten and Tamney of Grand Encampment, Wyo.

The single-hand contest was won by Big Bert Shively. I was able to get second money that day, but it was one of the two times I was beaten in the 15 contests I entered in the Nevada camps.

There was even a foot race for women. In 1905 women wore dresses that came right down to the ground. "Laigs," as Owen Wister called them in *The Virginian,* never were seen except on especially windy days. Mrs. Bill Parker, the wife of the mail-distributor and blacksmith, stood at the starting line holding each side of her dress. When the starter called "Go!" she grabbed that dress up and she just scooted down that 50 yards ahead of everybody, and boy, did she get some applause along with a nice purse!

The speechmaking at this first celebration was in the hands of no less a personage than Senator William Stewart, the great mining lawyer from Virginia City. The Senator had built a residence in Rhyolite and announced that he was going to spend the rest of his life there. I remember that he got up on a pile of lumber and orated for all of an hour in that hot desert sun. His beard was like Aaron's in the Psalms, for it "reached down to the skirts of his garments." He must have suffered.

In July I left Rhyolite and went back up to Tonopah. When I left, there were still but few buildings in town, and it was still a tent city. There were several stores by then, and goodness knows how many saloons. The famous bottle house wasn't started at that time, or I surely would remember it.

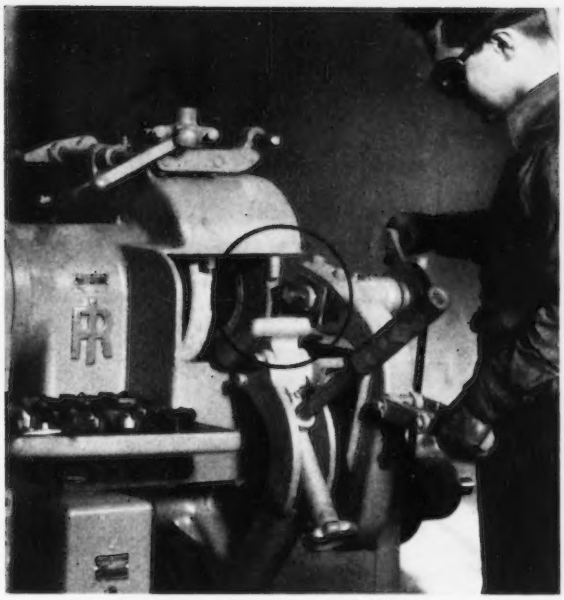
I went back to Rhyolite in 1907, and by then it was a real city with two railroads and a nice stucco depot. There was a large mill at the Shoshone mine and lots of men working.

I was there for the Fourth that year, and the celebration was about like the one before. Two Finlanders from Bonnie Clair got first money in the double-hand contest, and I managed to draw first money in the single-hand contest. It turned out that mine was the deepest hole (25⅞-in.) ever drilled in Rhyolite in a single-hand contest. The Finlanders were named Aronson and Gabrielson, and they drilled in Butte several times afterwards.

I have been back to Rhyolite several times during the last three years, and I'd say it was the outstanding ghost town of the desert today. The stucco depot is in good shape, and is now a casino where the curious who go to Rhyolite now can place a bet and be waited on by a barmaid. The bottle house, which has been photographed by thousands because it is built of 10,000 beer bottles cemented together, is the most substantial building in town. The cement jail is as good as when it was built, except that the doors are gone.

Back in 1951 another fellow and I went through Rhyolite on our way to go deer-hunting in Wyoming. We moved into the old jail house, built a fire on the floor, cooked our supper, and went to bed. It was the only time in my life I ever spent a night in jail.

All of which reminds me that I'm almost in the ghost town stage myself. It was 50 years this May since my brother and I rode up the hill on a six-horse stage into Tonopah for the first time. Then I could go to work in most any camp and be the youngest man on the job. Today I am the oldest Past Master of Rialto Masonic Lodge, and I have a 50-year jewel in the Oddfellows. I'm still a desert addict, however, and I'm still looking forward to another trip to the dry country and one more chance to throw a diamond hitch on a jackass.



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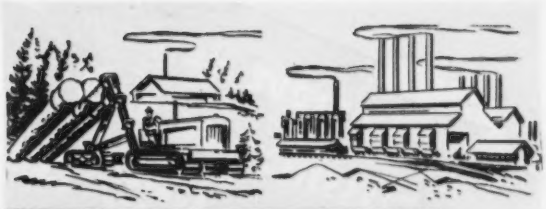

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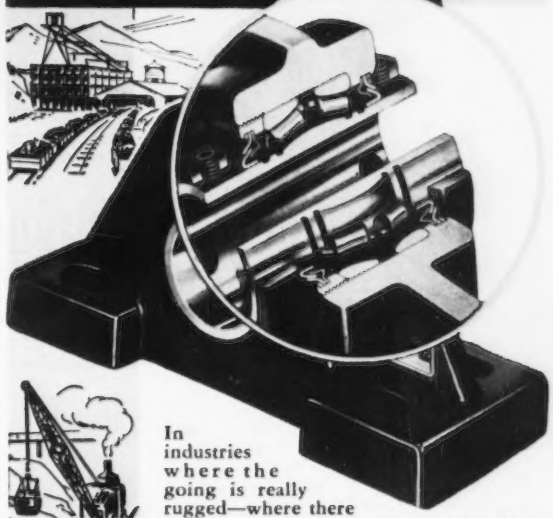

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New Products Digest *(Continued)*

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In July I left Rhyolite and went back up to Tonopah. When I left, the youngest man on the job. Today I am the oldest Past Master of Rialto Masonic Lodge, and I have a 50-year jewel in the Oddfellows. I'm still a desert addict, however, and I'm still looking forward to another trip to the dry country and one more chance to throw a diamond hitch on a jackass.

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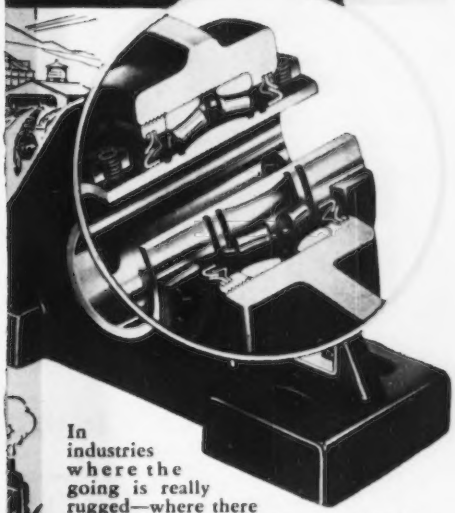

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Complete data, with specific information regarding their use in the mining industry, may be obtained on these equipment items by circling No. 1 on the postage-free reply card opposite page 110.

Boom at Rhyolite

(Continued from page 95)

The main event was the rock-drilling contest. I have forgotten what the purse was, but first money in the double-hand contest went to the Wray brothers, Zeb and Joe. I believe that Zeb afterwards got to be U. S. Marshal at Reno. Second money went to Marten and Tamney of Grand Encampment, Wyo.

The single-hand contest was won by Big Bert Shively. I was able to get second money that day, but it was one of the two times I was beaten in the 15 contests I entered in the Nevada camps.

There was even a foot race for women. In 1905 women wore dresses that came right down to the ground. "Laigs," as Owen Wister called them in *The Virginian*, never were seen except on especially windy days. Mrs. Bill Parker, the wife of the mail-distributor and blacksmith, stood at the starting line holding each side of her dress. When the starter called "Go!" she grabbed that dress up and she just scooted down that 50 yards ahead of everybody, and boy, did she get some applause along with a nice purse!

The speechmaking at this first celebration was in the hands of no less a personage than Senator William Stewart, the great mining lawyer from Virginia City. The Senator had built a residence in Rhyolite and announced that he was going to spend the rest of his life there. I remember that he got up on a pile of lumber and orated for all of an hour in that hot desert sun. His beard was like Aaron's in the Psalms, for it "reached down to the skirts of his garments." He must have suffered.

In July I left Rhyolite and went back up to Tonopah. When I left, there were still but few buildings in town, and it was still a tent city. There were several stores by then, and goodness knows how many saloons. The famous bottle house wasn't started at that time, or I surely would remember it.

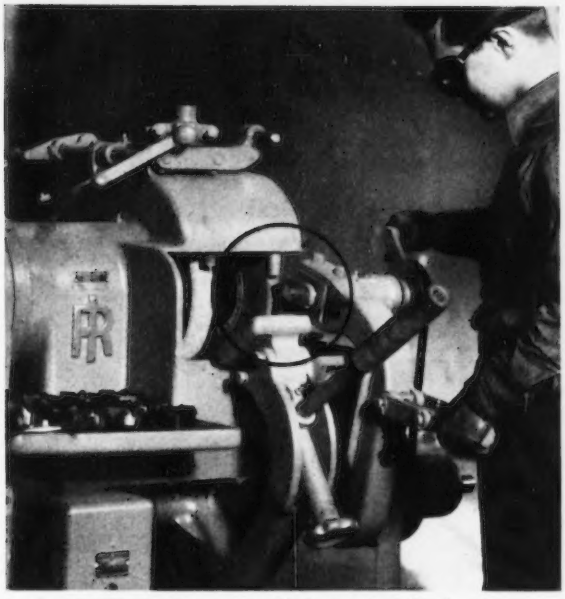
I went back to Rhyolite in 1907, and by then it was a real city with two railroads and a nice stucco depot. There was a large mill at the Shoshone mine and lots of men working.

I was there for the Fourth that year, and the celebration was about like the one before. Two Finlanders from Bonnie Clair got first money in the double-hand contest, and I managed to draw first money in the single-hand contest. It turned out that mine was the deepest hole (25⅞-in.) ever drilled in Rhyolite in a single-hand contest. The Finlanders were named Aronson and Gabrielson, and they drilled in Butte several times afterwards.

I have been back to Rhyolite several times during the last three years, and I'd say it was the outstanding ghost town of the desert today. The stucco depot is in good shape, and is now a casino where the curious who go to Rhyolite now can place a bet and be waited on by a barmaid. The bottle house, which has been photographed by thousands because it is built of 10,000 beer bottles cemented together, is the most substantial building in town. The cement jail is as good as when it was built, except that the doors are gone.

Back in 1951 another fellow and I went through Rhyolite on our way to go deer-hunting in Wyoming. We moved into the old jail house, built a fire on the floor, cooked our supper, and went to bed. It was the only time in my life I ever spent a night in jail.

All of which reminds me that I'm almost in the ghost town stage myself. It was 50 years this May since my brother and I rode up the hill on a six-horse stage into Tonopah for the first time. Then I could go to work in most any camp and be the youngest man on the job. Today I am the oldest Past Master of Rialto Masonic Lodge, and I have a 50-year jewel in the Oddfellows. I'm still a desert addict, however, and I'm still looking forward to another trip to the dry country and one more chance to throw a diamond hitch on a jackass.



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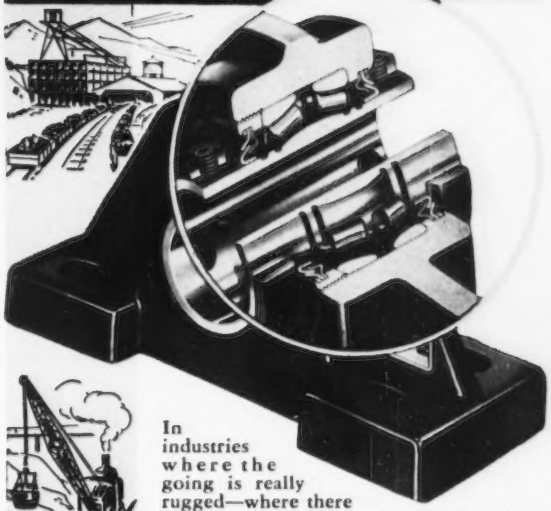

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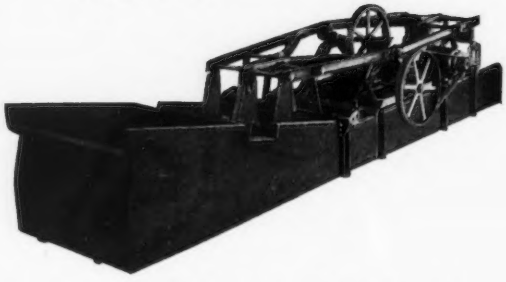

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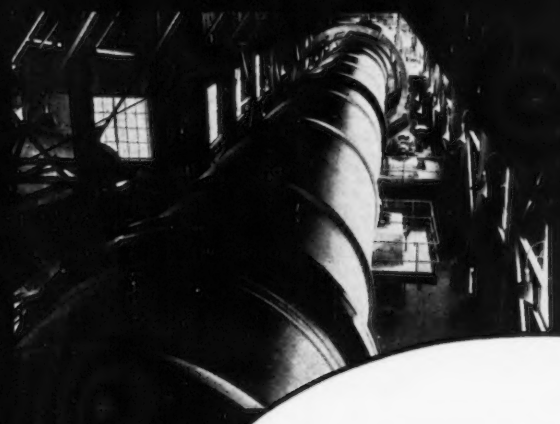

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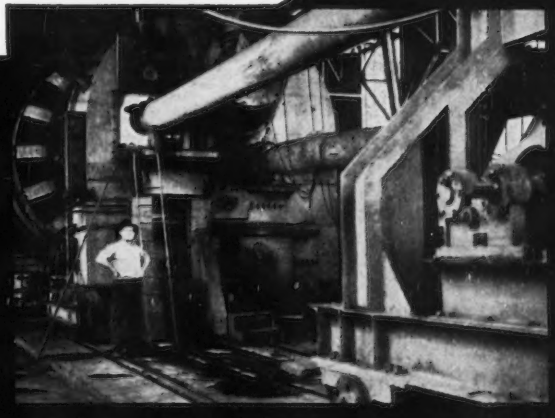

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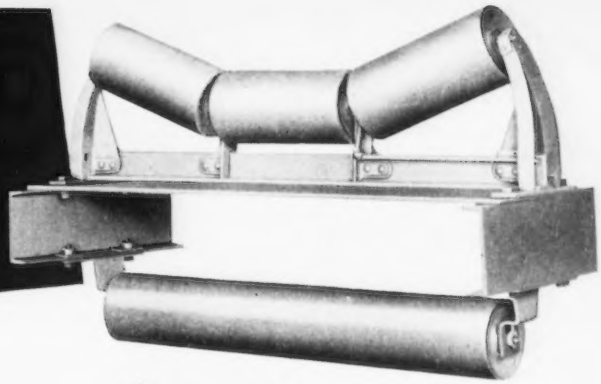

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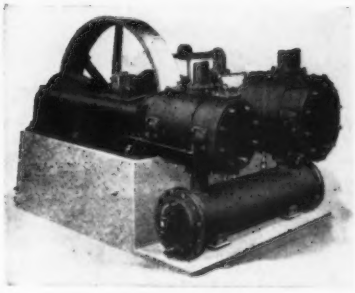

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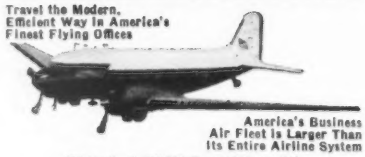

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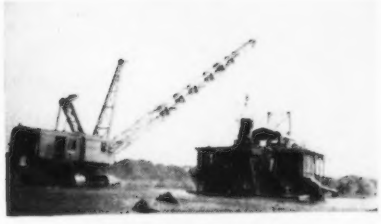

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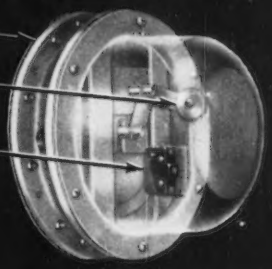

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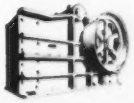

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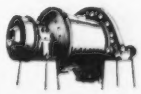

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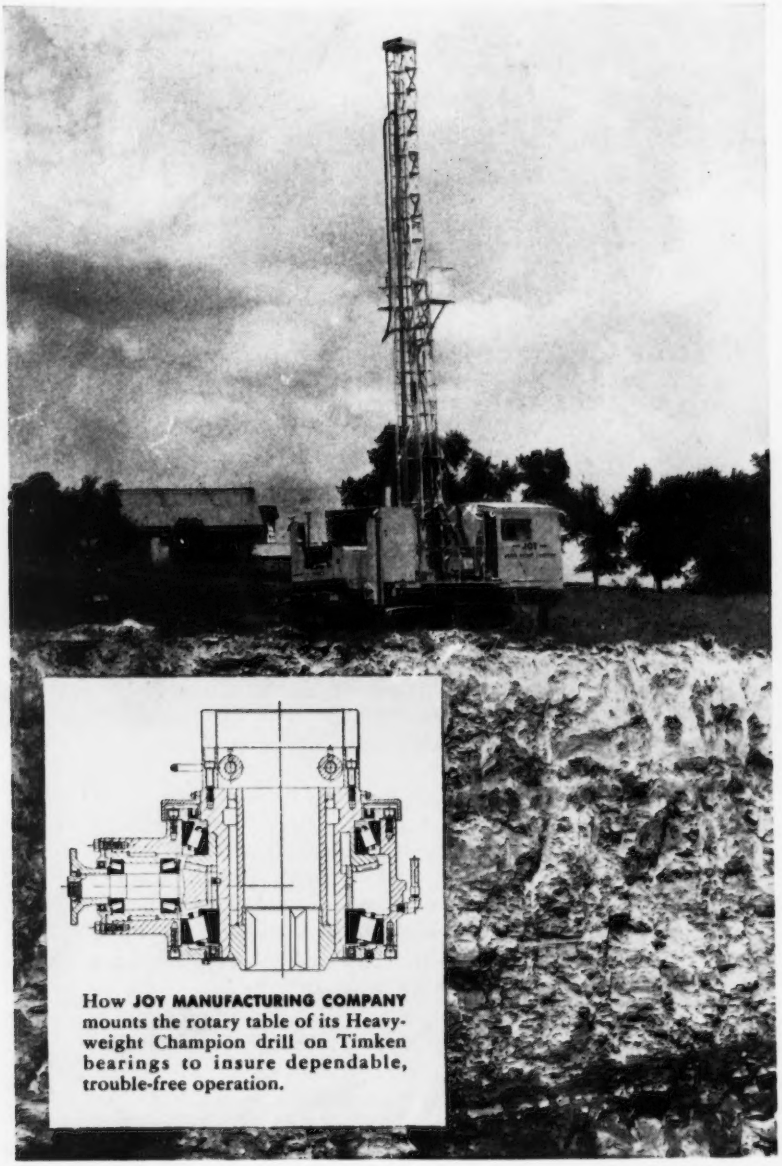

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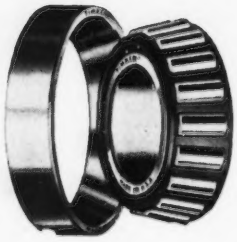

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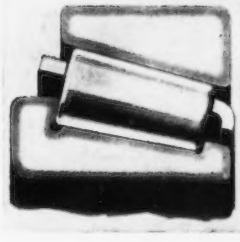

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